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Graham · Improvement of the Harbors of
Lake Machigan . St. Clair etc. 1859

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Library; Massachusetts Histl. Society
Boston.
From J. D. Graham
Dec. 12. 1860.

ANNUAL REPORT

OF

ames's

BREVET LIEUT. COL. J. D. GRAHAM,

MAJOR OF U. S. TOPOGRAPHICAL ENGINEERS,

ON THE

IMPROVEMENT OF THE HARBORS

OF

LAKES MICHIGAN, ST. CLAIR, ERIE, ONTARIO, AND CHAMPLAIN

ACCOMPANYING

THE DOCUMENTS SENT TO THE 35TH CONGRESS, AT ITS SECOND SESSION
BY THE PRESIDENT OF THE UNITED STATES, WITH HIS
ANNUAL MESSAGE OF DECEMBER 6, 1858.

WASHINGTON:
1859.

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REPORT.

Lieutenant Colonel J. D. Graham's report (No. 230) on the Lake harbor works under his direction, for the year 1858.

OFFICE GENERAL SUPERINTENDENCE OF LAKE HARBOR WORKS,
Chicago, November 15, 1858.

SIR: This, my annual report for the year 1858, on the Lake harbor works under my direction, relates to the improvement and repair of the harbors on the north and northwestern lakes, as follows, viz:

I. LAKE MICHIGAN.

1. Chicago harbor, Illinois.
2. Waukegan breakwater, Illinois.
3. Kenosha harbor, Wisconsin.
4. Racine harbor, Wisconsin.
5. Milwaukie harbor, Wisconsin.
6. Sheboygan harbor, Wisconsin.
7. Manitowoc harbor, Wisconsin.
8. Michigan City breakwater, Indiana.
9. New Buffalo harbor, Michigan.
10. St. Joseph harbor, Michigan.
11. Black Lake harbor, Michigan.
12. Grand Haven harbor, at the mouth of Grand river, Michigan.
13. Mouth of South Black river, Michigan.
14. Mouth of Kalamazoo river, Michigan.

II. LAKE SAINT CLAIR.

15. Mouth of Clinton river, Michigan.

III. LAKE ERIE.

16. Monroe harbor, mouth of the river Raisin, Michigan.
17. Sandusky harbor, Ohio.
18. Huron harbor, Ohio.
19. Vermillion harbor, Ohio.
20. Black River harbor, Ohio.
21. Cleveland harbor, Ohio.
22. Grand River (Fairport) harbor, Ohio.
23. Ashtabula harbor, Ohio.
24. Conneaut harbor, Ohio.
25. Erie harbor, Pennsylvania.
26. Dunkirk harbor, New York.
27. Buffalo harbor, New York.

IV. LAKE ONTARIO.

28. Oak Orchard harbor, New York.
29. Genesee harbor, (mouth of Genesee river,) New York.
30. Sodus Bay harbor, Wayne county, New York.
31. Sodus Bay harbor, Cayuga county, New York.
32. Oswego harbor, New York.
33. Ogdensburg harbor, New York.

V. LAKE CHAMPLAIN.

34. Burlington breakwater, Vermont.

The works and harbors in the above list, thirty-four (34) in number, were reported on in my annual report for 1857, printed in Senate Executive Document, No. 42 of the 35th Congress, 1st session, and also in H. R. Document, No. 23* of the same session. They will be taken up here in the same order.

I. LAKE MICHIGAN HARBOR WORKS.

1. CHICAGO HARBOR, ILLINOIS.

Repair of the harbor piers.

The dilapidated condition of the Chicago harbor piers has been fully set forth in my three previous annual reports on this harbor, to be found printed at pp. 22 to 127 and from pp. 302 to 336 of Senate Executive Document, No. 16 of the 34th Congress, 3d session, and at pp. 4 to 60 of Senate Executive Document, No. 42 of the 35th Congress, 1st session.

I regret to be obliged to report that the condition of these piers is now much worse than it has ever before been. The interests of commerce have suffered much from the want of means to repair them and to keep the bar subdued by dredging.

The timber work above water of the whole of the southern pier, and of that portion of the northern pier included between its eastern extremity and the most western angle, (marked A in red on the accompanying three copies of map G, No. 52,) is all now in so rotten a condition that it must be immediately torn away and substituted by sound materials.

I have here to repeat my recommendation that the whole of this pier work above a plane one (1) foot below the low water level be replaced by stone masonry. It is only in this way that this valuable commercial harbor can be permanently put in a condition essential to the commerce of the lakes. The great value and extent of this commerce were fully set forth in my annual report for 1855. It was my wish to exhibit it again, together with that of the other lake harbors under my direction for the present year, in this report, and for that object I have been collecting extensive statistics.

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* The report is more correctly printed in the Senate Document, No. 42, than in the H. R. Document, No. 23.

I have found it impossible, however, to digest and arrange them in a proper form in time for this report. I propose to make this the subject of a separate report at a future time, and as soon as practicable.

They will be found to contain very important results bearing upon the importance of keeping our lake harbors in good condition, considered, as heretofore, both in a military and commercial point of view, and they will be brought down to include the end of the present year, after the system which was adopted in my reports for 1855 and 1856, printed in Senate Executive Document, No. 16 of the 34th Congress, 3d session, p. 480.

The breach in the north pier, made on the 7th of November, 1857, by the collision of a vessel against it in a gale of wind, mentioned in a note at the bottom of page 10 (Senate Doc. No. 42 of last session) of my annual report for 1857, was repaired in the best manner that the limited amount of funds on hand would admit. This repair exhausted the balance of the last appropriation for this harbor.

On the 18th of August of the present year (1858) the schooner "Albany" was carried in a gale of wind violently against the north harbor pier at the point marked B in red on the accompanying three copies of map G, No. 52, and broke several of the timbers on the river face of the pier. The damage thus caused was, on the 4th of September following, much increased by a collision, near the same point, by the propeller "Free State," which broke every timber of the pier wall, from its top down to four (4) feet below the water surface, on the river face, and, extending through the pier, damaged several wall timbers on the landward face.

On the 1st of October ultimo the propeller "Sun," in entering the harbor, struck the north pier very near the point of collision of the "Albany" above mentioned, and not only carried away the repairs which followed the first mentioned injury, but also broke every timber from the top of the pier to two (2) feet below the water surface.

We now had to contend against a clear breach through the pier, causing the waves, in south and southeasterly winds, to wash and abrade the sandy shore of the river at the points in question.

During the present month of November the force of the lake sea, in strong gales of wind, has dislodged some of the timbers of the pier head at the east extremity of the north pier, and also at several other places along the south face of that pier. These timbers are either in such exposed positions and partly decayed, or in less exposed positions and so entirely decayed that they oppose very little resistance to these forces.

The damages above reported placed the harbor of Chicago in a very critical condition. Without a dollar of public money applicable to the requisite repairs, and with all the responsibilities resting upon me to save the harbor, by every means that I could legitimately command, from the destruction which awaited it unless the threatened breach from the river across the sandy promontory into the lake could be checked, I determined to set the United States dredge-boat to work on the bar to dig sand and sell it to raise funds for this object. Accordingly this was done, and with the proceeds, together with a small amount charged to light-house repairs, in order to prevent the communication to the beacon light from being cut off, the repairs have been attended to from time to time as these disasters occurred, and are, at this date, (November 15, 1858,) being continued. Of course these repairs can only be of a temporary character, owing to the very limited amount of money that can be commanded for them.

I must again recommend that the means to make the permanent repairs in stone be granted at as early a day as possible, and that they be in accordance with the plan set forth in the accompanying estimate, marked A 1.

Extension of the south harbor pier.

I also repeat the recommendation, contained in my annual reports for 1856 and 1857, that the south pier be extended four hundred and eighty (480) feet lakeward of its present terminus, and for the reasons given in full in those reports.—(See Senate Ex. Doc. No. 16, 34th Congress, 3d session, p. 311; and Senate Ex. Doc. No. 42, 35th Congress, 1st session, p. 11.) The necessary means for this extension are also in the estimate A 1.

A small basin for protection of United States property.

The United States have parted with all the ground which was held for public purposes under the Fort Dearborn reservation. They possess now no conveniences whatever for constructing the cribs for the south pier extension, or for the mooring of the United States steam dredge and her scows when at work for the improvement of this harbor, or for the protection of the floating machinery, such as pile-drivers, scows, harbor boats, &c., or for the security of the timber, delivered under contracts, for purposes of repair or construction. The cribs, to form a line of pier-work composed of wood, iron bolts, and stone ballast, must be built up to a certain height whilst afloat, and must, while this work in going on, be protected from the waves of the lake or river during windy weather. The steam dredge-boat, scows, floating pile-drivers, harbor-boats, &c., require equal protection when not at work.

For these several purposes I recommend that a basin be constructed at the angle formed by the junction of the Illinois Central Railroad Company's pier with the United States South harbor pier. The proposed dimensions for this basin are three hundred and twenty (320) feet long by one hundred (100) feet wide, and ten (10) feet deep.

It is drawn in red on the three accompanying maps, marked G No. 52, and the cost is included in estimate A 1.

A steam dredge for Chicago harbor.

It is considered very important that a steam dredging machine, with scows, should be provided especially for this harbor.

I have become more and more convinced, as I have become better acquainted with the character of the Chicago bar and the hydraulic law governing its formation, that it can best be kept subdued by habitual annual dredging, and at a much less expense than by any other means. We have already demonstrated, by the practical operations in 1854 and 1856, that a direct channel over this bar, by the north pier-head, can be kept constantly open to a width of three hundred and fifty (350) to four hundred (400) feet by thirteen (13) feet deep, for an annual expense, in using a dredging machine, of two thousand five hundred to three thousand dollars; that is to say, $2,500 to $3,000. On this point we would ask a reference to maps G, Nos. 11, 12, 38, 43, 44, and 52, to be found in the Topographical Bureau and in the archives both of the Senate and House of Representatives.—(See also Senate Ex. Doc. No. 16, 34th Congress, 3d session, pp. 22 to 26, and pp. 303 to 307.) *

We consider the idea of preventing the formation of the Chicago bar—either by an extension of the north harbor pier or by constructing a counter pier out in the lake, so as to produce an increased current in the channel-way to be left between it and the end of the north pier, for the purpose of wafting the silt to leeward, past the mouth of the river—as entirely inexpedient and inapplicable to the improvement in question. While either of these plans would be far more costly than dredging, neither of them would, in our opinion, ensure the same success.

The cost of the proposed steam dredging machine and scows is included in estimate A 1.

The dredging of Chicago bar.

A reference to the six maps of Chicago harbor and bar last mentioned, and also to maps G, Nos. 22 and 23, of the same harbor and bar, each showing their aspect at different periods between April, 1854, and April, 1857, will be sufficient to convince any one that however often this bar may be removed by dredging, it will re-form itself by the deposits caused by the meeting of the littoral or shore current of the lake with the obstruction of the east end of the north pier; and, moreover, that it will always assume identically the same direction, shape, and dimensions, as to width, which it had before being cut away by dredging.

Here, then, we have the uniform effect of a fixed hydraulic law exhibited, which is of great value in discussing the question as to the best mode of keeping an open channel through it, and also sure data for computing the expense of producing such a channel by dredging.

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* The net cost to the United States of the dredging of this bar in 1856 was erroneously printed in line 12, at page 307 of the above mentioned document, as $4 83 per cubic yard. It should have been printed 4.83 cents; that is to say, four cents and eighty-three hundredths of a cent per cubic yard.

In the present instance, in order to produce the desired channel to a depth of thirteen (13) feet below the ordinary or mean level of the lake, it will require the removal of twenty-two thousand (22,000 cubic) yards of sand.

The expense of this item is introduced in estimate A 1.

Recapitulation of items in estimate A 1, *hereto attached.*

1.	For repairing piers in stone masonry	$152,405 04
2.	For extending the south pier 480 feet	28,924 95
3.	For a basin for the preservation and protection of public property	18,080 47
4.	For a steam dredge and scows	17,500 00
5.	For dredging Chicago bar	2,200 00
6.	For a set of meteorological instruments	232 50
	Amount required for Chicago harbor	214,342 96

I recommend that the above sum be granted in two equal annual appropriations of $109,671 48 each.

A reference to the various positions occupied at various periods by the lake shore line, north of this harbor, shown on map G, No. 52, shows that, while the north pier projected into the lake far to the east of the shore line, the formation of new land by accretion caused by the deposits of the silt brought down by the littoral current was nearly in the direct ratio of the elapsed time; but that in proportion as the general direction of this new shore line approaches to a coincidence with the direction or thread of this littoral current, the increase is much less rapid, nearly in the inverse ratio of the elapsed time.

I mention these facts in refutation of the idea which has been advanced that the piers can produce no permanent benefit in keeping the harbor open, but that the shore-line will progress further and further out, until it transcends the eastern limit of the north pier.

By the aid of habitual dredging in the manner already mentioned, and at a comparatively small annual cost, there is no reason we think to doubt that the piers will perform effectually the office for which they were intended, and for a very long period to come, without a further extension into the lake.

Openings in the harbor piers to accommodate ship basins.—The second bond of the Illinois Central Railroad Company, dated May 21, 1858, and the conditions stipulated under which the said company was permitted to make a second opening in the United States south harbor pier to communicate with its second ship basin, have, since my last annual report, been duly executed, and is hereto attached, marked A, 2.

They are recorded at page 205, in Book No. 40 of Mortgages, in the office of the clerk and ex-officio recorder of Cook county, Illinois, at Chicago.

The reference map thereto appertaining is recorded in the same office in Book No. 143, at page 0, or one page preceding page 1.

The first bond of the same company, dated April 20, 1855, and the conditions under which it was permitted to make an opening in the said pier to communicate with its first ship basin are recorded in the same office at Chicago, at page 469, in Book 130, of Deeds. The illustrative map attached to the same is recorded at page 27, in Book 133, of Maps, in said office. These documents are printed at pages 58 to 62, in Senate (Ex.) Documents, No. 16, of the 34th Congress, 3d session.

The agreement and consent of the parties in interest to the line of excavation for the improvement of the navigation of Chicago river, under the act of Congress approved July 21, 1852, namely: John Baptiste Beaubien, the Illinois Central Railroad Company, the corporate authorities of the city of Chicago, and the United States, dated September 26, 1855, was duly recorded at page 463, in Book 130 of Deeds, and the reference map thereto attached was recorded at page 26½, (twenty-six and a half,) in Book 133, of Maps, in the same office. This paper is printed at pages 79 to 81 of the aforesaid senate document.

The bond of the Chicago Dock and Canal Company, dated November 11, 1858, and the conditions stipulated under which the said company has received permission to make an opening in the United States north pier of Chicago harbor, to communicate with the said company's intended ship basin and canals, authorized by the act of incorporation granted by the State of Illinois, of February 12, 1857,* have been duly executed by the said company, and is hereto attached, marked A, 3. So soon as the maps of reference can be completed the document will be forwarded for the action of the War Department, after which it will be recorded at Chicago.

Monthly averages of the elevation of the surface of Lake Michigan.

These were given in my annual report for 1857, for the period embraced between September 1, 1854, and September 30, 1857, embracing a period of three years.†

The observations upon the tide-gauge at the east end of the north pier, (see map,) have been continued to the present time.

From February 9 to March 15, inclusive, 1858, the gauge at this point was frozen fast in its box and did not operate. The registers for that period were, therefore, made by a similar tide gauge which, in November, 1857, I established within the well of the city water-works, situated (see map G, No. 52) a few feet east of Pine street, between Chicago avenue and Pearson street. Here the gauge is protected from freezing, even in the coldest weather. It was so adjusted, when set in position, that the zero (0) of its graduated rod is in the same level, or horizontal plane, with the zeros of the gauge at the east end of the north harbor-pier, and at Rush street bridge.

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* This act of incorporation is printed in Senate (Ex.) Doc., No 42, of the 35th Congress 1st session, at pp. 49 to 51.

† See page 7 of Senate (Ex.) Document, No. 42, 35th Congress, 1st session.

The following are the monthly averages from October 1, 1857, to October 31, 1858, a period of thirteen (13) months, viz:

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Monthly averages of the elevation of Chicago river at Rush street bridge Chicago. Tr;

Year.	Month.	Monthly mean height of the lake surface, per tide-gauge, in feet and decimals.
1857.	October, thirty-one days observed	3.913
	November, thirty days observed	3.136
	December, thirty-one days observed	3.110
1858.	January, thirty-one days observed	3.042
	February, twenty-eight days observed	2.783
	March, thirty-one days observed	2.904
	April, thirty days observed	3.221
	May, thirty-one days observed	3.704
	June, thirty days observed	4.125
	July, twenty-nine days observed	4.512
	August, thirty-one days observed	4.470
	September, thirty days observed	4.076
	October, thirty-one days observed	3.928

These were given in my annual report for 1857, (see page 8 of printed Senate Ex. Doc., No. 42, of the 35th Congress, 1st session,) from April 1, 1856, to September 30, 1857, embracing a period of eighteen months, from observations on the tide gauge at first situated at the old ferry, and afterwards at the ice-breaker of the Rush street bridge.—(See map G, No. 52.)

The following monthly averages are obtained from observations upon the same tide-gauge, made between the first of October, 1857, and the 31st of October, 1858, a period of thirteen (13) months. The zeros of the two tide gauges are in the same horizontal plane or level.

Monthly averages of the river gauge.

Year.	Month.	Monthly mean height of surface of Chicago river at Rush street bridge, in feet and decimals.
1857.	October, thirty-one days observed	4. 106
	November, thirty days observed	3. 303
	December, thirty-one days observed	3. 334
1858.	January, thirty-one days observed	3. 230
	February, only eight days observed; ice prevented more; river frozen	3. 056
	March, only eighteen days observed; river frozen over; the rest of the time this month	3. 197
	April, thirty days observed	3. 383
	May, thirty-one days observed	3. 867
	June, thirty days observed	4. 377
	July, twenty-nine days observed	4. 643
	August, thirty-one days observed	4. 720
	September, thirty days observed	4. 418
	October, thirty-one days observed	4. 128

From the foregoing results, it appears that the surface of Lake Michigan is at this time full two feet higher than it was in 1854.

This result has an important bearing on the question of height that should be given to all piers constructed on this lake.

They should not be less than five feet high above the extreme high-water stage of the lake along the margins of the rivers, and seven feet where they are bounded on both sides by the lake.

[redacted] LUNAR TIDE ON LAKE MICHIGAN.

The subject of a lunar tidal wave on our great fresh-water inland seas has attracted the attention of philosophers, so far as I am informed, only to a very limited degree.

From the comparatively small area of the waters to be acted upon by the lunar attraction, the disturbance in the elevation of their surface cannot, in any event, be but small. It is, indeed, so small that its measure is liable to be almost constantly exceeded by the effect of the winds. To obtain a satisfactory measurement of its co-ordinate requires careful observations at times when a calm lake-surface conspires with the period when the position of the moon in her orbit is such as to give her a maximum influence upon the tide. Patient and long-continued observations are indispensably necessary to obtain data sufficient for the complete solution of this problem.

During the past season I have instituted a series of observations touching this interesting question. Hourly, and sometimes half-hourly, observations have been made of the height of the lake-surface when the moon was near the full; and, so far as the investigation has progressed, it brings us to the conclusion that there is a perceptible lunar tidal-wave on Lake Michigan, whose co-ordinate, measured from the mean level of the lake-surface, is as much as fifteen-hundredths to two-tenths of a foot; that is to say, 0.15 to 0.2 of a foot.

I have not had time, apart from the regular official duties devolving on me here, to collate all the observations that have been made so as to attach them to this report. This will, however, be done, and they will be submitted at a future time. In the meanwhile the observations will be continued whenever circumstances shall be favorable. I do not doubt that they will prove the existence of a lunar tidal-wave in our great lakes to the extent above mentioned.

Latitude and longitude of Chicago.

In my annual report of last year the longitude of Chicago was given west of Greenwich, as determined by electric signals, based upon my determination of the longitude of the centre of the citadel of Quebec, in the year 1842.—(See pp. 12 to 22, and 56 to 60 of Senate Ex. Doc. No. 42 of the 35th Congress, 1st session.)

On the nights of the 15th and 23d of August, and the 18th of September last, I observed with the sextant for the latitude of this place.

The stars observed on were arranged in pairs, and were selected so that one should pass the meridian to the north and the other to the south of the zenith, and at nearly equal meridian altitudes. This was done for the purpose of eliminating any small and imperceptible errors that might appertain to the instrument, either in the graduation of the circular arc or limb, in the position of the mirrors, or in the collimation of the telescope; and likewise for the elimination of any error of personal equation appertaining to the observer.

The stars observed on for determining the *time* were also selected in pairs of nearly the same declination, both north in this latitude, and of such right ascension that one could be observed when near the east and the other when near the west prime vertical, with but little elapsed time between their being at nearly equal altitudes when in these respective positions. If they could not be observed on the prime vertical, care was taken to observe them both on the same side of that plane, either both when north or both when south of it.

This was done for the purpose of the same eliminations above described, and also for the elimination of any small errors in the determination of the latitude, which was to be used as a term in the formula for computing the time.

In some instances equal altitudes of the same star were observed, east and west or before and after passing the meridian, for computing the time. This method ensures a perfect elimination of all the errors above alluded to.

With these precautions a practised observer may, even with so light and portable an apparatus as a sextant of 7½ inches radius, with an artificial horizon of quicksilver, and a good watch or chronometer, obtain a pretty close determination of the latitude of a place by a few hours' work in a single night.

Observations.

1858, August 15. Time stars α (Alpha) Andromedæ E., and α (Alpha) Coroneæ Borealis W. Also equal altitudes of α (Alpha) Cygni.

LATITUDE OF STATION.

By 25 circum-meridian altitudes of Altair (α Aquilæ) S. combined with 17 ditto of γ (Gamma) Cephei N.	41° 53′ 46″.8
Samenight.—Latitude by 12 circum-meridian altitudes of α (Alpha) Aquarii S. combined with 10 altitudes of Polaris (α Ursæ minoris) N.	41° 53′ 45″.6
1858, August 23.—Time stars the same as on the 15th. Latitude by 24 circum-meridian altitudes of Altair S. combined with 18 ditto of γ (Gamma) Cephei N.	41° 53′ 47″.3
1858, September 18.—Time stars, α (Alpha) Andromedæ E., and α (Alpha) Coronæ borealis W. Also equal altitudes of α (Alpha) Pegasi	
Latitude by 15 circum-meridian altitudes of Altair S. combined with 26 ditto of γ (Gamma) Cephei N.	41° 53′ 46″.
Same night.—By 28 circum-meridian altitudes of α (Alpha) Aquarii, and 22 ditto of β (Beta) Aquarii, both S., combined with 18 altitudes of Polaris (α Ursæ min.) N	41° 53′ 45″.8
Result.—Latitude of station by giving each pair of stars an equal weight	41° 53′ 46″.3

The point of observation was sixty-two (62) feet due north of the front door steps of my quarters. It was in the middle of the sidewalk on the north side of Huron street, and eighty (80) feet east of the middle of Wolcott street. It is also four hundred and three (403) feet south of the parallel and two hundred and nine (209) feet west of the meridian of the observing station near the Roman Catholic church, which was occupied in May, 1857, for determining the difference of longitude between this place and Quebec; for a full account of which see Senate (Ex.) Doc. No. 42, of the 35th Congress, 1st session. The longitude of that station was then given, (see page 20) as west of Greenwich, 5h. 50m. 30s.99.

Its latitude from the above data is .... 41° 53′ 50″.3 N.

That station is near a point of triangulation in our survey of Chicago harbor, made in April, 1857, and was connected, in position, therewith by survey. It is marked "Temporary observatory" on map G, No. 52.

By our triangulation connected with the above two data we obtain.

G. Nº 52

the geographical positions of other remarkable objects in the city of Chicago.

They are all given in the following table, viz:

Positions in the city of Chicago.	North latitude.	Longitude west of Greenwich.	
		In time.	In arc.
	° ′ ″	h. m. s.	° ′ ″
1. Temporary observatory of May, 1857, near the Roman Catholic "Church of the Holy Name," on Wolcott street	41 53 50.3	5 50 30.99	87 37 44.8
2. Another ditto in ditto, of 1858	41 53 50.52	5 50 31.15	87 37 47.2
3. Observing station, north side of Huron street, eighty feet east of the middle of Wolcott street	41 53 46.3	5 50 31.2	87 37 47.5
4. Steeple (front door) of the Roman Catholic "Church of the Holy Name"	41 53 48	5 50 31.18	87 37 47.7
5. Steeple of the Protestant Episcopal church of St. James, on Cass street, corner of Huron street	41 53 45.2	5 50 30.87	87 37 43
6. Dome of the Chicago city hall or court-house.	41 53 6.2	5 50 32.08	87 38 1.2
7. Base of the new iron light-house (unfinished) at the end of the north harbor pier	41 53 24.9	5 50 27.93	87 36 59
8. Steeple of the west market-house, at the intersection of the middle of Randolph street with the west side of Des Plaines street	41 53 8.4	5 50 35.19	87 38 47.8
9. The point formerly occupied by the flag staff of Fort Dearborn, now destroyed	41 53 22.9	5 50 30.37	87 37 35.6

I have been thus particular because in drawing up a skeleton map of reference showing the relative positions of the harbors under my direction, and the consecutive distances between them, I was at first much deceived by the position assigned to Chicago by the American Almanac, a work that is much relied on as authority in this country. The position of Chicago is there given as in latitude 42° 0′ north, and longitude west of Greenwich 87° 35′, which is eight and one-third miles ($8\frac{1}{3}$ miles) of error in the assigned position of this place.

Very often the distance between two consecutive harbors proposed to be improved on the same lake-coast line, causes one of the two to be rejected, and hence it becomes important to the general lake commerce that the positions of these harbors should be laid down on a skeleton map of reference with approximate accuracy at least.

I am generally detained one night at each principal harbor when I make my visits of inspection, and if the Topographical Bureau will supply me with a good pocket chronometer, set on sidereal time, I can very easily, in one night of clear weather, fix the position of each with sufficient accuracy for our purpose, and thus correct some errors of magnitude in the reputed distances between harbors which the lake-coast survey has not reached, and may not for several seasons to come.

There is no balance remaining of the last appropriation, which was granted in 1852, for Chicago harbor improvement.

CHICAGO HARBOR, ILLINOIS.

A 1.

Estimate of the cost of repairing the United States piers at Chicago harbor, Illinois—for the extension of the south pier 480 *feet to the eastward—for a basin east of and adjoining the Illinois Central Railroad Company's pier—for building cribs—for mooring and protecting the United States harbor-boats, scows, floating pile-drivers, and timber—for a new steam dredge and scows—and for dredging the bar and the harbor between the piers.*

I. FOR THE REPAIRS OF THE PIERS IN STONE MASONRY.

This includes that portion of the north pier contained between the first angle, at the point marked A, in red on the accompanying copy of map G, No. 52, sent in triplicate with this report, and the east extremity of the said pier, a length of	2,032 feet.
Also the whole of the south pier from the ship basin of the Illinois Central Railroad Company to the east extremity of the said pier, a length (see map G, No. 52,) of	908 feet.
Total length to be repaired in stone masonry	2,940 feet.

It is proposed to tear away the old rotten timber work from the above portions of the piers, from a plane one foot below the level of extreme low water in Lake Michigan, and to rebuild with stone masonry from that plane to a height of seven feet above the same on that portion of the north pier included between the point A and the present lake shore, a distance of 1,452 feet. From thence to the east extremity of the north pier, a distance of 580 feet, it is proposed to rebuild with stone masonry to a height of nine feet above the same plane.

In regard to the south pier, it is proposed to rebuild with stone masonry from its west extremity to the point where it meets the Illinois Central Railroad Company's pier, a distance of 500 feet, to a height of seven feet; and from thence to its east extremity, a distance of 408 feet, to a height of nine (9) feet above the same plane.

The whole of that portion of the north pier proposed to be repaired is 24 feet wide, and the south pier has, throughout, a uniform width of 20 feet.

Hence we have four units of comparison for founding our estimate, each one being assumed at one hundred (100) feet long. They are to be applied respectively to the following portions of the two piers, viz:

1. 1,452 feet of the north pier, 24 feet wide, to be built to a height of 7 feet in masonry.
2. 580 feet of the north pier, 24 feet wide, to be built to a height of 9 feet in masonry.

3. 500 feet of the south pier, 20 feet wide, to be built to a height of 7 feet in masonry.

4. 408 feet of the south pier, 20 feet wide, to be built to a height of 9 feet in masonry.

The units for these four cases will be as follows, viz:

1. *Estimate of the cost of the unit,* 100 *feet long by* 24 *feet wide, and* 7 *feet high, for the north pier.*

For tearing away and removing decayed wood work and the ballast stone now within the pier to one foot below the level of extreme low water, and preparing the bed to receive the stone masonry, at $3 per lineal foot	$300 00
For 130 cubic yards of dressed stone masonry, to extend to a width of five (5) feet from the river face of the north pier, at $11 per cubic yard, laid in cement, with iron clamps and dowel pins	1,430 00
For 493 cubic yards of masonry, to consist of large quarry stones hammered to fair and safe bearings, laid in cement; for filling in between the face work of the north pier, at $5 per cubic yard	2,465 00
Estimated cost per 100 lineal feet of masonry, 24 feet wide and 7 feet high, (*a*)	4,195 00

2. *Estimate for the unit* 100 *feet long by* 24 *feet wide, and* 9 *feet high, for the north pier.*

For tearing away and removing the decayed wood work and the ballast stone now within the pier, as above, and preparing the bed to receive the stone masonry, at $3 per lineal foot	$300 00
For 333 cubic yards of dressed masonry, to extend to a width of 5 feet within the lakeward and the river faces of the north pier, at $11 per cubic yard, laid in cement, with iron clamps and dowel pins	3,663 00
For 467 cubic yards of masonry, to consist of large quarry stones, hammered as above, and laid in cement, for filling in between the face work of the north pier, at $5 per cubic yard	2,335 00
Estimated cost per 100 lineal feet of masonry, 24 feet wide and 9 feet high, (*b*)	6,298 00

3. *Estimate for the unit*, 100 *feet long by* 20 *feet wide, and* 7 *feet high, for the south pier.*

For tearing away and removing the decayed wood work and the ballast stone now within the pier, to one foot below the level of extreme low water, and preparing the bed to receive the stone masonry, at $2 75 per lineal foot	$275 00
For 130 cubic yards of dressed stone masonry, to extend as before, to a width of 5 feet within the river face of the south pier, at $11 per cubic yard, laid in cement, with iron clamps and dowel pins	1,430 00
For 389 cubic yards of masonry, of large quarry stones, hammered as above, and laid in cement back of the face wall, at $5 per cubic yard	1,945 00
Estimated cost per 100 lineal feet of masonry, 20 feet wide and 7 feet high, (*c*)	3,650 00

4. *Estimate for the unit of one hundred feet long, by twenty feet wide, and nine feet high, for the south pier.*

For tearing away and removing the decayed wood work and the ballast stone now within the pier, as above, and preparing the bed to receive the stone masonry, at $2 75 per lineal foot	$275 00
For 333 cubic yards of dressed masonry, to extend to a width of 5 feet within the lakeward and river faces of the south pier, at $11 per cubic yard, laid in cement, with iron clamps and dowel pins	3,663 00
For 333 cubic yards of masonry of large stones, hammered to fair bearings, and laid in cement between the face walls, at $5 per cubic yard	1,665 00
Estimated cost per 100 feet of masonry, &c., 20 feet wide and 9 feet high, for the south pier, (*d*)	5,603 00

Using the four units of comparison above given, we get—

For 1,452 feet of the north pier to be built up 7 feet high and 24 feet wide, at (*a*) $4,195 per 100 lineal feet	$60,911 40
For 580 feet of the north pier to be built up 9 feet high and 24 feet wide, at (*b*) $6,298 per 100 lineal feet	36,528 00
For 500 feet of the south pier to be built up 7 feet high and 20 feet wide, at $3,650 (*c*) per 100 lineal feet	18,250 00

For 408 feet of the south pier to be built 20 feet wide and 9 feet high with masonry, at $5,603 (*d*) per 100 feet of length	22,860 24
Sum	138,550 04
Add 10 per cent. for contingencies	13,855 00
(I.) Estimated cost of repairing both the north and south piers in stone masonry	152,405 04

II. FOR EXTENDING THE SOUTH PIER FOUR HUNDRED AND EIGHTY FEET TO THE EAST.

This will require the addition of 15 cribs to the present south pier, each 32 feet long, 20 feet wide, and 15 feet high from the bottom to the surface, or 20 feet high from the bottom to the flooring at top.

These cribs should be constructed in accordance with the drawings given in the detail on sheet G No. 20, now in the Topographical Bureau, and also in the archives of the United States Senate at Washington, being case 2 of my plans of crib work.—(See also the specifications contained in the table T 2, at pp. 16 to 18 of Senate Ex. Doc. No. 16 of the 34th Congress, 3d session, and the formula of computation at page 15 of the same document.)

The cost of one such crib will be as follows, viz:

For 2,419 lineal feet of pine timber, hewed or sawed, 1 foot square, at 17 cents per lineal foot	$411 23
For 880 lineal feet of white oak timber, hewed or sawed, 1 foot square, at 19 cents per lineal foot	167 20
For 1,482 feet, board measure, of white oak plank, 3 by 8, flooring, at $20 per M	29 64
For 3,167 pounds of 1 inch square wrought iron for bolts, at 4 cents per pound	126 68
For 137 pounds of wrought iron spikes, ⅜ by ⅜ of an inch square, 7½ cents per pound	10 28
For 63½ cords of hard stones for crib ballast, at $8 per cord of 128 cubic feet	508 00
For labor, carpentry, sinking in position, and filling with stone, and superintendence	500 00
Sum	1,753 03
Add 10 per cent. for contingencies	175 30
Estimated cost of 1 crib	1,928 33
(II.) Then 15 cribs, at $1,928 33 each, gives as the cost of extending the south pier of Chicago harbor 480 feet to the east	28,924 95

III. FOR A BASIN TO PROTECT THE PUBLIC PROPERTY AND FOR BUILDING CRIBS.

The United States possess no grounds nor conveniences for construction, nor for protecting the harbor property, such as the steam dredging machine, floating pile-drivers, scows, boats, timber, &c.

It is proposed to provide such a protection by building a basin at the angle formed by the south harbor pier and the Illinois Central Railroad Company's pier, to occupy the position drawn in red on the accompanying three copies of map G No. 52. The basin here represented is 320 feet long by 100 feet wide, and would communicate with the Chicago river by means of an opening to be made in the south pier 35 feet wide.

For the construction of such a basin there will be required 420 lineal feet of crib work, to be built in water of ten feet average depth. Hence there will be required the equivalent of 13⅛ cribs, each 32 feet long by 20 feet wide, and 15 feet high from bottom to top. It is proposed to construct them in accordance with case 2d of crib work, and the specifications contained in table T 2, to be found at pages 16 to 18 of my report No. 116, as printed in Senate Executive Doc. No. 16 of the 34th Congress, 3d session; and as also shown on sheet marked "G, No. 20," now in the Topographical Bureau, and in the archives of the United States Senate.

Estimate of the cost of one such crib.

For 1649 lineal feet of pine timber, hewed or sawed 1 foot square, at 17 cents per lineal foot	$280 33
For 880 lineal feet of white oak timber, hewed or sawed 1 foot square, at 19 cents per lineal foot	167 20
For 1482 feet, board measure, of white oak plank, 3 by 8, for flooring, at $20 per M	29 64
For 2,322 pounds of 1 inch square wrought iron, for bolts, at 4 cents per pound	92 88
For 137 pounds of wrought iron spikes, ⅜ by ⅜ of an inch square, at 7½ cents per pound	10 28
For 46½ cords of ballast stone, at $8 per cord	372 00
Cost of materials for one crib	952 33
For labor, carpentry, sinking in position, and filling with stone, and superintendence	300 00
Sum	1,252 33
Add 10 per cent. for contingencies	125 23
Estimated cost of one crib	1,377 56
(III.) Then 13⅛ cribs, at $1,377 56 each, give for the cost of this basin	18,080 47

IV. *For a steam dredge boat and scows for Chicago harbor.*—This estimate will be found in full detail at pp. 334 and 345 of my report, as printed in Senate Doc. No. 16 of the 34th Congress, 3d session. It amounts to $17,500 00

V. *For dredging Chicago harbor and bar.*—For the excavation and removal of twenty-two thousand cubic yards of sand, at 10 cents per cubic yard $2,200 00

VI. For a set of meteorogical instruments, as per item marked 6 of my report for 1856, printed at page 335 of the aforesaid Senate document $232 50

RECAPITULATION OF ITEMS.

1. For repair of piers in stone masonry	$152,405 04
2. For extending the south pier 480 feet east	28,924 95
3. For a basin for protection of the public property, &c.	18,080 47
4. For a steam dredge, and four scows, for Chicago harbor	17,500 00
5. For dredging Chicago harbor and bar	2,200 00
6. For a set of meteorogical instruments	232 50
Amount of estimate	219,342 96

J. D. GRAHAM,
Major Top. Corps of Eng'rs, B't Lt. Col. Superintending Engr.

Colonel J. J. ABERT,
Chief Topographical Engineers, Washington.

A 2.

Second bond of the Illinois Central Railroad Company to the United States, and conditions in reference to the second opening in the United States south pier of Chicago harbor, for the said company's benefit, 1858. *(Recorded in book No.* 40 *of mortgages, on page* 205. *The map of reference recorded in book* 143, *page* 0—*that is to say the page next preceding page* 1, *in the office of the Recorder of Cook county, Illinois.*

Know all men by these presents, that the Illinois Central Railroad Company doth hereby acknowledge itself to owe and to be indebted unto the United States of America, in the penal sum of two hundred thousand dollars, lawful money of the United States; for the payment of which said sum, well and truly to be made it doth hereby bind itself, its successors, and assigns, solemnly and firmly by these presents.

In witness whereof, the said company has caused this bond to be signed by its president and treasurer, and its corporate seal to be thereunto affixed at their office, at the City of Chicago, this twenty-first day of May, one thousand eight hundred and fifty-eight.

Now, the condition of the above obligation is such, that whereas the said United States of America hath, upon the application of the said company, consented to allow the said company to make a second opening in the United States south pier of the harbor of Chicago, to communicate with the said company's proposed second ship basin, adjoining their depot grounds and grain houses at Chicago, in consideration of which said consent, the said company hath agreed, and doth by these presents agree to keep, observe, and perform certain terms, conditions, stipulations, and agreements, deemed essential by the United States to the future security, safety, and accommodation of the navigation and commerce of the people of the United States, carried on at the said Chicago, and the future security and permanence of the public works and harbor at Chicago, and embodied and contained in certain articles of consent and agreement, bearing even date with these presents, to which reference is hereby made, which said articles are mutually signed, and triplicated by the respective parties hereto through their authorized agents.

Now, therefore, if the said Illinois Central Railroad Company shall well and truly on its part keep, observe, perform, and comply with the terms, stipulations, covenants, and conditions, and agreements contained in the said articles, upon its part to be kept and performed, and every part thereof, according to the true spirit and meaning and intent of said articles and the conditions thereof, then, and in that case, the above obligation to be void, otherwise to remain in full force and virtue.

The Illinois Central Railroad Company, by

[SEAL.] W. H. OSBORN,
President of the Illinois Central R. R. Company.
J. N. PERKINS,
Treasurer of the Illinois Central R. R. Company.

These articles of consent and agreement, made and concluded this twenty-first day of May, one thousand eight hundred and fifty-eight, by and between the United States of America, acting through the War Department of the United States, of the one part, and the Illinois Central Railroad Company of the other part,

Witness, that upon the express application of the said Illinois Central Railroad Company for permission to cut a second opening from their depot grounds at Chicago, through the south pier of the Chicago harbor, for a communication with the said company's proposed second ship-basin, adjoining the said depot, the said United States of America hath consented to grant and does hereby grant such permission, upon the express reservations, conditions, and terms hereinafter expressly stated and set forth, to be well and truly kept, complied with, observed, and performed by the said Illinois Central Railroad Company, with this express reservation, however, that upon failure at any time by the said company to so keep, comply with, and observe and perform the terms and conditions herein contained, and every part thereof to be kept and performed, that the said United States may revoke such consent so, as aforesaid expressly granted, and that in such case the said Illinois Central Railroad Company seall be at all the expense of closing such opening in the said pier, and of properly restoring the said pier and harbor in as good and perfect condition to the United States as the same were in before the grant of such permission was made; and that such closing shall be made and carried on under the direction, orders and supervision of such engineer or engineers as shall be designated for that purpose by the War Department of the United States.

And whereas, in consideration of such grant of the permission so given by the United States, as aforesaid, to the said company, it is deemed essential by the United States to the future security and permanence of the harbor and public works of Chicago, and also to the future security, safety, and accommodation of the navigation and commerce of the people of the United States, carried on and to be carried on at Chicago, that the said consent should only be made upon the conditions, terms, stipulations, reservations, agreements, and covenants, herein expressly agreed to, reserved, and contained on the part of the company:

Now, therefore, the said Illinois Central Railroad Company, in consideration as aforesaid, doth hereby expressly promise, agree, and stipulate to and with the United States, as follows, to wit:

1st. That before any proceeding towards a second breach or opening in the said south pier is commenced, the said company shall have closed the walls or crib-work of their ship basin on all sides, in such manner as to render them sufficiently water-tight to prevent any current between the said ship basin and Lake Michigan, and also so as to prevent any current and any water communication between the said ship basin and any other basin which may have an open communication with the said lake.

2. That there shall never be made any other opening or water communication between the said ship basin and Chicago river than that now granted through the said south pier of the said harbor at the point marked F, on the chart marked "Map G, No. 43," hereunto attached, without the express consent, previously obtained, of the War Department of the United States, in writing, upon such further conditions as may be mutually assented to and agreed upon.

3. That ~~upon~~ a good and sufficient communication along the said south pier shall be constructed across the said second opening therein, by means of a drawbridge moving on iron wheels or rollers, and running on an iron railway, whose direction shall be in the prolongation to the east of the present direction of that portion of the south pier which lies eastward of the said proposed second opening, as shown on the said Map G, No. 43, herteo attached.

4. That there shall be constructed at each extremity of the said second opening in the south pier, a good and sufficient abutment pier for the support of the said drawbridge, and that these two abutment piers shall be of masonry, resting at a depth of two feet below the

level of the surface of the water at its lowest ascertained state at the point in question, upon piles; the said drawbridge and abutment peirs to be in accordance with such dimensions, plan, and specifications as shall be approved by the Topographical Bureau, and sanctioned by the War Department of the United States.

5. That the aforesaid second opening in the south pier shall not progress or be carried on until such time as shall be previously recommended by the Topographical Bureau and approved by the War Department of the United States.

6. That the expenses of making the aforesaid second opening and the drawbridge, and the two abutment piers, and all their appurtenances, shall be borne by the said Illinois Central Railroad Company, its successors and assigns, and shall be carried on under the direction, control and supervision of such engineer or engineers as shall be designated by the War Department of the United States, whose duty it shall be to adhere and conform to the dimensions, plan, specifications aforesaid.

7. That all repairs and renewals of any part or the whole of the aforesaid work shall always, and at all times, be at the expense of the said Illinois Central Railroad Company and their successors and assigns, and in accordance with such plan and specifications as shall be approved by the War Department of the United States.

8. That the jurisdiction over and the control of the said drawbridge and abutment piers and all their appurtenances, shall always be vested in the United States in as full a manner as the piers constructed at the expense of the said States; and that they shall always be subject to such rules and regulations in regard to the manner and time of opening and closing the said drawbridge as shall, from time to time, be specified, required, and directed by the War Department of the United States.

9. It shall be at the option of the War Department of the United States, whenever it shall deem any of the conditions and stipulations aforesaid violated on the part of the said Illinois Central Railroad Company, to revoke the permission so as aforesaid granted, and to cause the aforesaid second opening in the south pier to be closed.

10. That in case of such revocation being made, and notice in writing thereof served upon the agent or agents of the said Company at Chicago or New York, the said Illinois Central Railroad Company shall close the said second opening, and restore said pier and harbor in as good and perfect condition as the same were in at the time of the granting of the aforesaid permission; and that upon a failure on the part of the said Company so to do, the War Department of the United States shall proceed and restore the said pier and harbor, and the said Company hereby stipulates and agrees, in such case, to pay all the expenses of such restoration to the United States.

It is hereby further expressly understood, that for a more full and perfect explanation of the conditions, covenants, and agreements of these articles, and the references therein made to the map hereto attached, that the same entitled "Map G, No. 43, Chicago harbor and bar Illinois, from survey made between the 10th and 15th September, 1856, under the direction of Brevet Lieutenant Colonel J. D. Graham, Major United States Topographical Engineers, superintending engineer of Lake Michigan works, showing the ship channel dredged out between April 22d and September 15th, 1856," shall constitute and be regarded as an integral part of these articles to accompany the same; and to which, for greater certainty, reference is hereby expressly made. In testimony whereof, these articles, bearing even date, as above expressed, with the bond hereto prefixed, are signed in triplicate by W. R. Drinkard, Acting Secretary of War, on the part of the United States, with the seal of the War Department hereunto affixed, at Washington, the fourteenth day of July, 1858, and by W. H. Osborn, President, and J. N. Perkins, Treasurer of the said Illinois Central Railroad Company, with the corporate seal of the said Company also hereunto affixed, at their office at the city of Chicago, Illinois, the twenty-first day of May, in the year one thousand eight hundred and fifty-eight.

[SEAL.] W. R. DRINKARD,
Acting Secretary of War.
W. H. OSBORN,
President of the Illinois Central R. R. Company.
[SEAL.] J. N. PERKINS,
Treasurer of the Illinois Central R. R. Company.

No. 5801.

STATE OF ILLINOIS, *Cook County.*

Filed for record August twenty-fifth, A. D., 1858, and recorded in book No. 40 of mortgages, on page 205. Map of reference recorded in book 143, page O.

WM. L. CHURCH,
Clerk of Circuit Court and Ex-Officio Recorder Cook County.

A 3.

Bond of the Chicago Dock and Canal Company, and conditions in reference to an opening in the United States north pier of Chicago Harbor, for the said Company's benefit.

Know all men by these presents, that the Chicago Dock and Canal Company doth hereby acknowledge itself to owe and to be indebted unto the United States of America in the penal sum of two hundred thousand dollars, lawful money of the United States; for the payment of which said sum well and truly to be made, it doth hereby bind itself, its successors, and assigns solemnly and firmly by these presents.

In witness whereof, the said company has caused this bond to be signed by its president and secretary, and its corporate seal to be thereunto affixed at its office at the city of Chicago, this eleventh day of November, one thousand eight hundred and fifty-eight:

Now, the condition of the above obligation is such that whereas the said United States of America have, upon the application of the said company, consented to allow the said company to make an opening in the United States north pier in the harbor of Chicago, to communicate with the said company's proposed ship basin and canal to adjoin the said north pier of Chicago harbor, in consideration of which said consent the said company hath agreed and doth by these presents agree to keep, observe, and perform certain terms, conditions, stipulations, and agreements, deemed essential by the United States to the future security, safety, and accommodation of the navigation and commerce of the people of the United States, carried on at the said Chicago, and the future security and permanence of the public works and harbor at Chicago, and embodied and contained in certain articles of consent and agreement bearing even date with these presents, to which reference is expressly made, which articles are mutually signed and triplicated by the respective parties hereto, through their authorized agents:

Now, therefore, if the said Chicago Dock and Canal Company shall well and truly on its part keep, observe, perform and comply with the terms, stipulations, covenants, and conditions and agreements contained in the said articles upon its part to be kept and performed, and every part thereof, according to the true spirit and meaning and intent of said articles and the conditions thereof, then and in that case the above obligation to be made void, otherwise to remain in full force and virtue.

The Chicago Dock and Canal Company by
[SEAL.] MAHLON D. OGDEN,
President.
FRANKLIN HATHEWAY,
Secretary.

These articles of consent and agreement made and concluded this eleventh day of November, one thousand eight hundred and fifty-eight, by and between the United States of America, acting through the War Department of the United States of the one part, and the Chicago Dock and Canal Company of the other part.

Witness that upon the express application of the said Chicago Dock and Canal Company for permission to cut an opening from its proposed ship basin and canal at Chicago through the north pier of the Chicago harbor for a communication with the said company's proposed ship basin and canal to adjoin the said north pier, the said United States of America have consented to grant and do hereby grant such permission, upon the express reservations, conditions, and terms hereinafter expressly stated and set forth, to be well and truly kept, complied with, observed, and performed by the said Chicago Dock and Canal Company, with this reservation however, that upon failure at any time by the said company to so keep, comply with, and observe and perform the terms and conditions herein contained and every part thereof to be kept and performed, that the said United States may revoke such consent so as aforesaid expressly granted, and that in such case the said Chicago Dock and Canal Company shall be at all the expense of closing such opening in the said pier, and of properly restoring the said pier and harbor in as good and perfect condition to the United States as the same were in before the grant of such permission was made, and that such closing shall be made and carried on under the direction, orders, and supervision of such engineer or engineers as shall be designated for that purpose by the War Department of the United States.

And whereas, in consideration of such grant of the permission so given by the United States, as aforesaid, to the said company, it is deemed essential by the United States to the future security and permanence of the harbor and public works at Chicago, and also to the future security, safety, and accommodation of the navigation and commerce of the people of the United States carried on and to be carried on at Chicago, that the said consent should only be made upon the conditions, terms, stipulations, agreements, and covenants herein expressly agreed to, reserved, and contained.

Now, therefore, the said Chicago Dock and Canal Company, in consideration as aforesaid, doth hereby expressly promise, agree, and stipulate, to and with the United States, as follows, to wit:

1. That before any proceeding towards a breach or opening in the said north pier is commenced, the said company shall have closed the walls or crib works of its ship basin, and canal or canals, and harbors on all sides, and shall continue to keep them and all such of their works closed in such manner as to render them sufficiently water tight to prevent any current between Lake Michigan and the said ship basin, and the said canal or canals, and harbors, and also so as to prevent any current and any water communication between the said ship basin, canal or canals and harbors, and any other basin or water way which may have an open communication with the said lake.

2. That there shall never be made any other opening or water communication between the said ship basin, or between the said canal or canals, or between the said harbors or any of them, and Chicago river than that now granted through the said north pier of Chicago harbor at the point marked A on the chart marked "map G, No. 58," hereto attached, without the express consent, previously obtained in writing, from the War Department of the United States, upon such further conditions as may be mutually assented to and agreed upon.

5. That the said company's basins, canals, and harbors, shall have parapets or walls sufficiently high to prevent the lake waves from washing over them, and from producing a current through them into Chicago river.

4. That a good and sufficient communication along the said north pier shall be constructed across the said opening therein by means of a drawbridge moving on iron wheels or rollers, and running on an iron railway, whose direction shall be in the prolongation of the present direction of that portion of the north pier where the opening shall be made, as shown on the said map G, No. 58, hereto attached.

5. That there shall be constructed, at each extremity of the said opening in the north pier, a good and sufficient abutment pier for the support of said drawbridge, and that these two abutment piers shall be of masonry resting upon piles at a depth of two feet below the level of the surface of the water at its lowest ascertained state, at the point in question; the said drawbridge and abutment piers to be in accordance with such dimensions, plan and specifications, as shall be approved by the Topographical Bureau and sanctioned by the War Department of the United States.

6. That the aforesaid opening in the north pier shall not progress or be carried on, until such time as shall be previously recommended by the Topographical Bureau and approved by the War Department of the United States.

7. That the expenses of making the aforesaid opening, and the drawbridge, and the two abutment piers, and all their appurtenances, shall be borne by the said Chicago Dock and Canal Company, its successors and assigns, and shall be carried on under the direction, control and supervision of such engineer or engineers as shall be designated by the War Department of the United States, whose duty it shall be to adhere and conform to the dimensions, plan and specifications aforesaid.

8. That all repairs and renewals of any part or the whole of the aforesaid work shall always and at all times be at the expense of the said Chicago Dock and Canal Company and its successors and assigns, and in accordance with such plan and specifications as shall be previously submitted to, and approved by the War Department of the United States.

9. That no work constructed or to be constructed by the said company, its successors or assigns, shall interfere with or encroach upon the position which previous to the charter granted by the State of Illinois to the said company, was chosen and adopted by the Light-house Board of the United States, for the erection of the new light-house for Chicago harbor; the said position being in lake Michigan, adjacent to the east end of the north pier of said harbor, and is bounded as follows, to wit: Beginning at the east end of said north pier at the point marked B on the accompanying map G, No. 58, and also marked B on the accompanying "plan of the position of the new light-house and keeper's house for Chicago harbor, with the piers of defence for the same," and running thence north twenty-four degrees and twenty minutes west, one hundred and six feet to the point marked C on the said map and plan, thence north seventy degrees west, one hundred and thirty feet to the point D on the said map and plan, thence south eighteen degrees west, one hundred and twenty two and a half feet to a point marked E on the said map and plan, which point E is on the south face of the said north pier of Chicago harbor; thence along the south and east faces of the said north pier, on the lines E F, F G, G B, to the point of beginning as marked on the said map and plan; the courses here marked being the true courses, as compared with the true meridian and not the magnetic; which said position as above

described and delineated, is the sole property of the United States and their successors and assigns forever.

10. That the jurisdiction over and the control of the aforesaid drawbridge, and abutment piers, and all their appurtenances shall always be vested in the United States, in as full a manner as the piers constructed at the expense of the said States, and that they shall always be subject to such rules and regulations in regard to the manner and time of opening and closing the said drawbridge as shall from time to time be specified, required and directed by the War Department of the United States; and that the said opening and closing shall be done by or at the expense of the said Chicago Dock and Canal Company.

11. That it shall be at the option of the War Department of the United States when it shall deem any of the conditions and stipulations aforesaid violated on the part of the said Chicago Dock and Canal Company, its successors or assigns, to revoke the permission so as aforesaid granted, and to cause the aforesaid opening in the North pier to be closed.

12. That in case of such revocation being made, and notice in writing thereof served upon the president, or other agent or agents of the said company, the said Chicago Dock and Canal Company shall close the said opening and restore said pier and harbor in as good and perfect condition as the same were in at the time of the granting of the aforesaid permission; and that upon a failure on the part of the said company. its successors or assigns so to do, the War Department of the United States shall proceed and restore the said pier and harbor; and the said company hereby stipulates and agrees in such case to pay all the expenses of such restoration to the United States.

13. It is hereby further expressly understood that for a more full and perfect explanation of the conditions, covenants, and agreements of these articles, and the references therein made to the maps hereto attached, that the same entitled "map G, No. 58, Chicago harbor and bar, Illinois, from survey made between the 17th of August and the 2d of September, 1858, under the direction of Brevet Lieutenant Col. J. D. Graham, major United States Corps of Topographical Engineers, superintending engineer of Lake Harbor works," and map G, No. 59, "Plan of the position of the new light-house and keeper's house for Chicago harbor, with the piers of defence for the same, by Brevet Lt. Colonel J. D. Graham, superintending engineer of Chicago light-house," shall constitute and be regarded as integral parts of these articles, to accompany the same, and to which for greater certainty, reference is hereby expressly made.

In testimony whereof these articles bearing even date as above expressed with the bond hereto prefixed, are signed in triplicate by the Secretary of War, on the part of the United States, with the seal of the War Department hereunto affixed, at Washington, the —— day of ————, and by Mahlon D. Ogden, president, and Franklin Hatheway, secretary, of the said Chicago Dock and Canal Company, with the corporate seal of the said company also hereunto affixed at its office, at the city of Chicago, Illinois, the eleventh day of November, one thousand eight hundred and fifty-eight.

[Seal of the
War Office.]

——— ———,
Secretary of War.

[Seal of the Chicago Dock
and Canal Company.]

MAHLON D. OGDEN,
*President of the Chicago Dock
and Canal Company.*
FRANKLIN HATHEWAY,
Secretary of the Chicago Dock and Canal Company.

STATE OF ILLINOIS,
County of Cook, City of Chicago, } *ss.*

I, Charles R. Sheldon, a notary public in and for said city, in the county and State aforesaid, do hereby certify that Mahlon D. Ogden, president of the Chicago Dock and Canal Company, and Franklin Hatheway, secretary of said company, who are personally known to me as such, appeared before me this day in person, and acknowledged the foregoing bond and the articles of agreement thereto attached to be their free act and deed, for and in behalf of the said Dock and Canal Company, and that the seal attached thereto is the seal of the said company.

[Notarial seal.] Witness my hand and notarial seal, this 11th day of November, in the year 1858.

CHARLES R. SHELDON,
Notary Public.

2. WAUKEGAN BREAKWATER, ILLINOIS.

My annual report, No. 116, for the year 1855, contains full information in regard to this work, with an estimate in full detail of its cost under the proposed plan, amounting to $137,966 10.

That report is printed in Senate Ex. Doc. No. 16 of the 34th Congress, 3d session, at pages 127 to 140.

My report for the following year (1856) is printed in part 2 of the same document, at pages 337 and 338.

As no work has been carried on there since that period, owing to no appropriation having been made since the year 1852, I beg leave to refer to those reports as containing all the information I have to offer on this subject.

A map of reference, marked G No. 29, on a scale of $\frac{1}{2400}$, or two hundred feet to one inch, with the proposed improvement drawn thereon, was sent in duplicate to the Topographical Bureau, with my report for 1855, one of which was sent to the United States Senate.

There is a balance of three hundred dollars ($300) remaining in hand of the appropriation for this work, which is due to Sweet, Ives & Hawley for wrought iron delivered by them under contract before I was put in charge of these lake harbor works, and which has been used for bolts in constructing cribs.

They were long ago invited by me to come forward and execute a lawful voucher upon which I could pay them the amount, but they have failed to do so. The money awaits their proceedings on this point.

3. KENOSHA HARBOR, WISCONSIN.

No balance remains of the last appropriation (made in 1852) for this harbor, and no work has been carried on there since the year 1855.

The improvements required to be made there are fully described in my reports for the years 1855 and 1856, which are printed in the above-mentioned Senate document, at pages 140 to 180 and 338 to 339. The estimates, in full detail of items, are printed at pages 173 to 177, amounting in all to the sum of $58,047 24.

The amounts under the different heads are as follows, viz:

1. For the protection of the harbor from a deposit of the drifting sand blown across the piers into the channel	$750 00
2. For the extension of the harbor piers	19,096 88
3. For dredging necessary to produce a depth of 12 feet over the bar, and between the United States piers, and also a depth of 10 feet in the proposed channel EF, (see maps G, Nos. 30, 42 and 53, in the Topographical Bureau, and also in the archives of the United States Senate,) this channel to be 600 feet long and 160 feet wide	8,464 80
4. For deepening the basin to 10 feet, west of the United States piers	9,669 22
5. For increasing the capacity of this basin, by deepening its north and west arms to 10 feet	20,065 34
Amount of appropriation required to complete Kenosha harbor, Wisconsin	58,047 24

I recommend that the above sum be granted in one appropriation, as it can be judiciously expended for the objects stated in one year, or at farthest in a year and a half, and it is for the completion of this harbor.

4. RACINE HARBOR, WISCONSIN.

No balance remains of the last appropriation (of 1852) for this harbor. It was expended in the year 1855, as stated in my previous reports.

My annual report for 1857 gives a full account of the condition of this harbor, up to September 30 of that year.

I consider the pier extensions recommended in that report as very necessary, and for that object I beg leave to renew here my estimate given in detail at page 63 of Senate Ex. Doc., No. 42, of the 1st session of the 35th Congress, amounting to the sum of $17,422 73

To this should be added:

For raising the piers to five feet above the present level of Lake Michigan, equal so seven feet above the ordinary level of this lake	$3,500 00
For dredging 15,000 cubic yards, at 30 cents	4,500 00
Amount required for Racine harbor, Wisconsin	25,422 73

I recommend that this sum be granted in one appropriation.

Racine has completed her railroad connexion with the Milwaukee and Mississippi railroad, and thence with the Mississippi river at Prairie du Chien.

Very soon another connexion with the Mississippi river at Savanna will be completed. This last line has already been extended from Racine to Durand, in the State of Illinois.

These improvements have already greatly increased the quantity of agricultural products carried to Racine for shipment eastward, and also the supply of goods brought from the east and distributed through the western country. Hence it is very important, both to the agricultural and commercial interests of that region of country, that the improvements of the harbor of Racine should be completed as soon as possible.

A great error has heretofore prevailed in the assigned position of Racine, and hence in regard to its proximity to Milwaukee, the next harbor to the north.*

On the 6th of September last I inspected this harbor, and at night made the following observations with a sextant and time piece No. 1, (sidereal) for ascertaining the latitude and longitude.

The position occupied was two hundred and ninety-seven (297) feet N. 87° 05 E. from the centre of the dome of the court-house of Racine.

1. *For the Time.*

	h.	*m.*	*s.*
Time-piece No. 1, fast of Racine sidereal time :			
By 9 observations on *a* (Alpha) Andromedæ, E	1	07	37.1
By 13 observations on *a* (Alpha) Coronæ borealis, W	1	07	36.7
Result for the Time: Time-piece No. 1, fast of Racine sidereal time, Sept. 6, 1858, at (19*h.* 46*m.*)	1	07	36.9

On the 5th and 7th of September the time was observed with time-piece No. 1, (sidereal) at station No. 3, (on Huron street, Chicago,) given in the preceding table of latitudes and longitudes of positions in that city, viz:

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*See Senate debates, at page 1678 (right hand column) of part 3d of the Congressional Globe for 1856, 34th Congress, 1st session.

1. 1858, *September* 5. Time piece No. 1, fast of Chicago sidereal time :

	h.	m.	s.
By 10 observations on *a* (Alpha) Coronæ borealis, west··	1	06	53.8
By 12 observations on *a* (Alpha) Andromedæ, east ······	1	06	54.7
Result for the Time: Time-piece No. 1, fast of Chicago sidereal time, Sept. 5, 1858, (at 19*h.* 45*m.*)········	1	06	54.25
By comparison: Time-piece No. 2 was slow of Chicago mean solar time, (at 8*h.* 45*m.* mean solar,) the same night······································	0	04	28.5

2. 1858, *September* 7. Time-piece No. 1, fast of Chicago sidereal time :

	h.	m.	s.	h.	m.	s.
By 9 observations on *a* (Alpha) Andromedæ, east····				1	07	06.7
By 15 observations on *a* (Alpha) Lyræ, W.	1	07	06.51			
By 8 observations on *a* (Alpha) Aquilæ, W.	1	07	06.53			
By 23 observations on *a* Lyræ and *a* Aquilæ, west ····				1	07	06.5
Result for the Time: Time-piece No. 1, fast of Chicago sidereal time, September, 7, 1858, (at 21*h.* 23*m.*)···				1	07	06.62
By comparison: Time-piece No. 2, was slow of Chicago mean solar time, (at 10*h.* 15*m.* mean solar,) the same night······································				0	04	28.36

Daily Rates, from September 5th to September 7th, 1858 :
No. 1, sidereal, +6*s.*, on sidereal time.
No. 2., mean solar, +0.07*s.*, on mean solar time.

The above rates will be presently used, in connection with a comparison of Racine time with Chicago time, in order to obtain the difference of longitude between these two places, by means of electric signals transmitted forth and back along the telegraph wires. For this purpose, time-piece No. 2 (mean solar) remained at Chicago.

We now continue the observations at Racine.

2. *For the Latitude of Racine.*

LATITUDE OF STATION.

By 11 circum-meridian altitudes of Altair (a Aquilæ) S.	42° 43′ 43″.2
By 11 circum-meridian altitudes of γ (Gamma) Cephei, N.	42° 43′ 46″.3
Result. Latitude of station·····················	42° 43′ 44.″7

3. *For the Longitude of Racine.*

Between the observations on *a* (Alpha) Andromedæ, east, for the time, and γ (Gamma) Cephei, north for the latitude, the following time-signals were passed by the electric telegraph between Chicago and Racine to obtain the difference of longitude between the observing stations at the two places.

The times of the signals were recorded at Chicago by the mean solar time-piece No. 2, which was left there for the purpose, and they rest on the accuracy of the observations made there for the time on the 5th and 7th of September, as above given, and on the rate of that time-piece during an elapsed time of twenty-six hours.

The same signals were recorded at Racine by the sidereal time-piece No. 1, resting on the accuracy of the observations made for the time there immediately preceding those signals and the rate of that time-piece for about two hours.

A few experimental signals were, in the first place, made to obtain satisfactorily the period of a coincidence of beats or clicks between the two time-pieces. This accomplished, it was easy, by applying the rates of the two time-pieces and the gain of sidereal on mean solar time, to give signals at Racine that should avoid fractions of a beat at either station, and also to name the moments that signals should be made at Chicago by the time-piece there that would equally avoid such fractions in recording the signals by the two time-pieces.

In this way neither the eye nor the ear [illegible] was taxed to estimate the value of fractions of a beat. The fractions of a second of time, if any, attaching to the deduced difference of longitude between the meridians of the two stations are given by exact computation in reducing the sidereal time recorded at Racine to its equivalent mean solar period, in order to a direct comparison with the mean solar time actually recorded at Chicago; or, *vice versa*, in reducing the mean solar time recorded at Chicago to its equivalent sidereal period preparatory to a comparison with Racine sidereal time, as actually recorded there by time-piece No. 1.

The following is a record of the signals made at the two stations, with the results carried out, and showing the difference of longitude deduced from each.

Determination of the difference of longitude between Chicago and Racine by electric signals for comparisons of time, September 6, 1858.

1.—CHICAGO SIGNALS RECORDED AT BOTH STATIONS.

Times of signals given at Chicago by mean solar time-piece, No. 2.	Time-piece No. 2, slow of Chicago mean solar time.	Correct Chicago mean solar time of Chicago signals.	Times of Chicago signals as noted at Racine by sidereal time-piece, No. 1.	Time-piece No. 1 fast of Racine sidereal time.	Racine correct sidereal time of Chicago signals.	Chicago correct sidereal time of Chicago signals.	Difference of longitude by each signal; Racine west of Chicago.
h. m. s.	*m. s.*	*h. m s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
11 16 50	4 28.42	11 21 18.42	23 32 17.5	1 07 37.55	22 24 39.95	22 25 16.75	0 00 36.80
11 19 40	4 28.42	11 24 08.42	23 35 08	1 07 37.57	22 27 30.43	22 28 07.22	36.79
11 31 40	4 28.42	11 36 08.42	23 47 10	1 07 37.62	22 39 32.38	22 40 09.19	36.81
11 34 42	4 28.42	11 39 10.42	23 50 12.5	1 07 37.63	22 42 34.87	22 43 11.68	36.81
11 37 41	4 28.42	11 42 09.42	23 53 12	1 07 37.64	22 45 34.36	22 46 11.17	36.81

1st Mean.—Electric fluid transmitted from Chicago to Racine .... 0*h.* 00*m.* 36*s.*804.

II.—RACINE SIGNALS RECORDED AT BOTH STATIONS.

Times of signals given at Racine by sidereal time-piece No. 1.	Time-piece No. 1, fast of Racine sidereal time.	Times of Racine signals, as noted at Chicago by mean solar time-piece No. 2.	Time-piece No. 2 slow of Chicago mean solar time.	Chicago correct mean solar time of Racine signals.	Chicago correct sidereal time of Racine signals.	Racine correct sidereal time of Racine signals.	Difference of longitude—Racine west of Chicago.
h. m. s.	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m s.*
23 38 8.5	1 7 37.58	11 22 40.00	4 28.42	11 27 8.42	22 31 7.71	22 30 30.92	0 0 36.79
23 41 09	1 7 37.59	11 25 40.00	4 28.42	11 30 8.42	22 34 8.20	22 33 31.41	36.79
23 44 10.5	1 7 37.60	11 28 41.00	4 28.42	11 33 9.42	22 37 9.69	22 36 32.90	36.79

	h. m. s.
2d Mean.—Electric fluid transmitted from Racine to Chicago	0 0 36.79
1st Mean.—Electric fluid transmitted from Chicago to Racine, as above	36.804
Result: Racine west, in longitude of Chicago, by a mean of the two sets of signals	36.8
Longitude of the observing station for the time at Chicago, resting on—1st, Lieutenant Colonel Graham's determination of the longitude of the centre of the citadel of Quebec in November, 1842, = 4*h.* 44*m.* 49*s* 65 ; 2d, difference between Quebec and Chicago, as determined by electric signals in May, 1857	5 50 31.2
Longitude of the observing station at Racine, west of Greenwich	5 51 8.0

Position of the observing station at Racine, as above determined.

	° ′ ″
Latitude	42 43 44. 7
	h. m. s.
Longitude, west of Greenwich, in time	5 51 08. 0
	° ′ ″
Do......do......do....in arc	87 47 00. 0

By measured azimuths with a theodolite, and distances with a chain, from the above observing station, we obtain, for more convenient reference, the positions of the following permanent objects at Racine, viz:

Positions in the City of Racine.	Latitude north.	Longitude west of Greenwich.	
		in time.	In arc.
	° ′ ″	h. m. s.	° ′ ″
1. Dome of the court-house, situated between 5th and 6th streets, and 100 feet west of the west margin of Main street	42 43 44. 6	5 51 8. 26	87 47 4.0
2. The tower of St. Luke's church, (Episcopal)	42 43 45. 4	5 51 8. 06	87 47 1.0
3. The steeple of the Universalist church of the Good Shepherd	42 43 44. 3	5 51 8. 06	87 47 0.9

The signals at Racine were all made by myself. To one who has had much practice in counting the beats of a chronometer for the purpose of noting the time of an observation, it is not so difficult, as might be supposed, to make these telegraphic signals in close—*exact*, I may almost say—coincidence with any given beat of a chronometer. I think it will be found that the accuracy of signals made in this way, for time comparisons between two distant stations where a sidereal time-piece is used at the one and a mean solar at the other, approaches very near to that which is secured by a self-recording clock which gives the signals by the action of its pendulum in breaking the electric circuit.

The signals at Chicago were made by an experienced telegraph operator there, after having been carried through a course of practice in making signals to correspond with the beat of the chronometer at every ten (10) seconds of interval.

The tabulated results given above of the difference of longitude between the two stations by the several signals will serve to show the degree of accuracy that may be attained in this way.

It will be seen that the extreme difference in the results for the longitude, from the eight signals that were passed, is only .02, or $\frac{1}{50}$ (one-fiftieth) of a second of time, although the correction for *rate* of one of the time-pieces incorporated in the calculation amounted in the extreme to .09, or $\frac{9}{100}$ (nine one-hundredths) of a second of time.

The position of Racine is given by Captain T. J. Cram from astronomical observations by himself, in his report on his survey of 1841, of the boundary line between Michigan and Wisconsin, as follows:

	Latitude north.	Longitude west of Greenwich.
Racine, Wisconsin Territory, (west shore of Lake Michigan).	42° 49′ 33″	87° 40′ 22″

(See Senate Doc., No. 170, of the 27th Congress, 2d session, page 7,) which places it too far north in latitude + 5′ 48,″ and too far to the east in longitude — 6′ 42.″

This is an absolute error in geographical position of eight and three-fourths (8¾) miles, on a course of N. 40° 25′ E. from the true position, and affects the distance to the next harbor, as will be presently shown.

5. MILWAUKEE HARBOR, WISCONSIN.

The whole of the appropriation of 1852 for the improvement of this harbor has been expended, as heretofore reported.

For a full report upon the importance of this harbor, both in a military and a commercial point of view, I beg leave to refer to my previous reports printed in Senate Executive Document No. 16, of the 34th Congress, 3d session, and No. 42 of the 35th Congress, 1st session.

My annual report for 1857, contained in the last mentioned document, shows the condition of this harbor on the 30th of September of that year in regard both to the new harbor at the "North Cut" and the old or original harbor at the natural entrance of Milwaukee river. I will now proceed to state what has since been done at each and the condition of each at the present time.

1. *The new harbor at the "North Cut."*

The piers for the formation of this new harbor were reported on the 30th of September last, as completed to the necessary depth out into the lake. Since that time there has been placed at the lakeward, or east extremity of each of these piers, a crib 32 feet square, ranging centrally with the middle line or axis of the piers. They are designed to serve as pier-fenders in the case of collision by vessels in entering the harbor in dark weather during heavy northeasterly winds. These pier-fenders lie in 14 feet depth of water, and are built up to a height of eight (8) feet above the level of the lake surface, as it was in November, 1857. They are strongly built and bolted after the plan shown in the sheet of drawings, marked G, No. 20, now in the Topographical Bureau, and in the specifications for case 2d of crib work, contained in pages 8 to 12, and 16 to 18 of Senate Executive Doc., No. 16 of the 34th Congress, 3d session.

The interior or river faces of the new piers forming the new harbor have also been defended against the collision of vessels coming in under strong winds, and from their chafing while lying along side. This has been done by longitudinal stringers of oak timber hewn or sawed one foot square, which are bolted to the pier timbers one foot above the present water level. They are made to occupy, consecutively, the spaces between the interior oak piles which are marked *e e e*, in figures 4 and 5 (four and five) in each of the sheets of drawings, showing our method of crib work, now in the Topographical Bureau, and in the archives of the Senate, marked G, Nos. 19, 20, and 21.

The United States steam dredge for Lake Michigan, continued her operations in dredging this new harbor, from the date of my last annual report (September 30, 1857,) to the 16th of November of that year.

Her operations were resumed on the 8th of May, and continued until the 27th of July, 1858. During these two working periods she excavated and removed 49,120 cubic yards. This added to the 32,404 cubic yards* excavated and removed previous to October 1, 1857, as before reported, makes the total quantity excavated and removed in 1857 and 1858, for the creation of this new harbor by the United States dredge, 81,524 cubic yards.

An account of each day's work done since October 1, 1857, and a recapitulation showing all that was done both in 1857 and 1858, by the United States dredge-boat, is given in the accompanying statement marked B 1.

Besides this a large amount of dredging has been done in both seasons by scoop dredges employed under the city contract, in deepening this new harbor and the channel of the river above.

The great benefit of these improvements is shown by the facilities with which the largest class of lake vessels enter and leave this new harbor, and by the greatly increased commerce of the port of Milwaukee.

At this time, fourteen (14) feet can be carried from the harbor entrance, through the whole width and length of the channel formed by the new piers, thence through the cut which connects with the river, and thence up the river for a distance of one mile above the cut. It must be remembered, however, that the lake is now full two (2) feet higher than its mean stage. At the mean stage, then, the depth throughout would be reduced to twelve (12) feet.

2. *The old harbor at the natural mouth of Milwaukee.* River.

The importance of keeping up this old harbor at the natural entrance of Milwaukee river, is fully exposed in the reports of the late Board of Topographical Engineers, of May 28, 1843, and March 4, 1854. The first will be found printed in Senate Ex. Doc. No. 1, of the 33d Congress, 1st session, part 3d, pp. 183 to 186; and the second in Senate Ex. Doc. No. 1, of 33d Congress, 2d session, part 2, page 237.

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* See Senate Ex. Doc. No. 42, of the 35th Congress, 1st session, page 65.

In regard to our own views, they were, after careful examination of the subject based on a careful survey, fully expressed in our annual report (No. 116,) of December 31, 1855.—(See p. 206 of Senate Ex. Doc. No. 16, of the 34th Congress, 3d session.) Further observation of the natural advantages of this harbor, combined with the rapidly increased commerce of Milwaukee, induce us to reiterate here the expression of the same views.

I regret to have to report that the piers for the protection of this old harbor, have, since the period of my last annual report, been almost entirely destroyed from their rotten condition, and the action of the winter, ice, and storms. This fate was predicted in that report unless an appropriation was soon made for their repair.—(See Senate Ex. Doc. No. 42, of the 35th Congress, 1st, session, pp. 67 and 68.)

The south pier is almost entirely swept away above the water level. All that remains of it is the skeleton appearance afforded by some of the upright piles, and some irregularly scattered timbers which protrude their heads above water.

The condition of the north pier is not much better.

The consequence of this state of ruin is that the sea breaks through when the winds are from the eastward, and extends its waves far within the natural entrance of the river, and there deposits the sand carried along.

A shoal has thereby been formed which diminishes the depth there to from three to nine (3 to 9) feet at the present high stage of the lake surface. At the ordinary or mean stage of the lake, there would be only from one to seven (1 to 7) feet.

Throughout that part of the river included between the new and the old harbor, the depth has become much diminished, and unless soon attended to, a very valuable roadstead or anchorage will be totally lost to Milwaukee.

A breach two hundred and fifty-six (256) feet long has been made through the promontory or land strip, which formed the eastern shore of the river here, and protected the channel of the river from the lake sea.

The depth of this breach is about six (6) feet in the middle, and unless stopped by crib-work, it will become wider from the continued action of the same force at the present high stage of the lake, and this valuable barrier may be destroyed.

To stop this breach and thus check its progress, will require a line of crib-work two hundred and fifty-six (256) feet long, with an average of four (4) feet depth in the water, or a height of nine (9) feet from bottom to top.

For these repairs, and for dredging, I submit the following estimates, viz :

1. For repairs of the north and south piers, I offer the estimate contained in my last annual report ; (see pp. 71 and 72 of Senate Doc. No. 42, 35th Congress, 1st session) amounting to	$28,630 41

2. For repairing the breach in the land strip which separates the lower part of Milwaukee river from Lake Michigan, as per the accompanying estimate marked B 2	$4,290
3. For dredging, I offer the estimate marked B 4, at pages 72 and 73 of the same Doc. amounting to,	11,710 85
Amount required for repairing the harbor at the natural mouth of Milwaukee river	44,631 42

I would recommend the granting of this sum in one appropriation.

The latitude and longitude of Milwaukee.

As Milwaukee is one of the principal harbors on Lake Michigan, whether considered in point of importance as a harbor of refuge for the accommodation of the lake navigation generally, or in reference to the value of its own local commerce and navigation, it seems essential that its geographical position, and hence its relative position to other harbors, should be correctly laid down upon a reference map which I hope, before long, to be able to present, of reliable authority for the object stated.

For this purpose I carried my portable instruments with me on my late tours of inspection of the harbor, and of the operations of the United States steam dredge, and after the day's duties were over, made the following observations at night, viz :

As the longitude was to be obtained by comparisons with the meridian of Chicago, already well established, from Greenwich, the time corresponding to that meridian was the initial element in the operation. I will begin therefore by giving in a brief form, the results of the observations made there for the time.

The same instruments were used as before described.

Observations for the time at Chicago.

The station occupied was 179 feet west of the meridian and 24 feet north of the parallel of the observing station of May, 1857, already described under the head of Chicago harbor. It is the station marked No. 2 in the table of positions in Chicago. It is in latitude 41° 53′ 50″.5 N.; longitude west of Greenwich 5*h.* 50*m.* 31*s.*15=87° 37′ 47″.2.

1. 1858, June 22.—Time piece No. 1 fast of Chicago sidereal time for this station:

By fourteen observations on α (Alpha) Lyræ, E	0*h.* 59*m.* 30*s.*90
By sixteen observations on α (Alpha) Bootis, W	0*h.* 59*m.* 30*s.*53
Result: Time piece No. 1 fast of Chicago sidereal time, June 22, 1858, (at 15*h.* 52*m.*)	0*h.* 59*m.* 30*s.*70
By comparison: Time piece No. 2 was slow of Chicago mean solar time (at 9*h.* 48*m.* mean solar) same night	4*m.* 58*s.*33

2. 1858, June 28.—Same station.—Time-piece No. 1 fast of Chicago sidereal time for this station:

By ten observations on *α* (Alpha) Lyræ, E·········· 1*h*. 00*m*. 07*s*.92

By twelve observations on *α* (Alpha) Bootis, W···· 1*h*. 00*m*. 07*s*.20

Result: Time-piece No. 1 fast of Chicago sidereal time, June 28, 1858, (at 15*h*. 52*m*.)············· 1*h*. 00*m*. 07*s*.56

By comparison: Time-piece No. 2 was slow of Chicago mean solar time (at 9*h*. 25*m*.) same night···· 4*m*. 53*s*.75

Mean daily rates from June 22 *to June* 28, 1858.

No. 1, sidereal, +6*s*.14 per sidereal day.

No. 2, mean solar, +0*s*.76 per mean solar day.

At Chicago station No. 3, (see table,) in latitude 41° 53′ 46″.3 N.; longitude 5*h*. 50*m*. 31*s*.2 W.

3. 1858, June 30.—Time-piece No. 1 fast of Chicago sidereal time for this station:

By ten observations on *α* (Alpha) Coronæ Borealis, W. 1*h*. 00*m*. 21*s*.22

By thirteen observations on *α* (Alpha) Andromedæ, E. 1*h*. 00*m*. 20*s*.48

Result: Time-piece No. 1 fast of Chicago sidereal time June 30, 1858, (at 19*h*. 45*m*.)············· 1*h*. 00*m*. 20*s*.85

By comparison: Time-piece No. 2 slow of Chicago mean solar time (at 13*h*. 09*m*.) same night······ 4*m*. 53*s*.1

4. At station No. 2 (see Chicago table) in longitude 5*h*. 50*m*. 31*s*.15 W.

1858, July 3.—Time-piece No. 1 fast of Chicago sidereal time for this station:

By six observations on *α* (Alpha) Lyræ E·········· 1*h*. 00*m*. 36*s*.95

By twelve observations on *α* (Alpha) Cygni, also E· 1*h*. 00*m*. 37*s*.40

By a mean from two east stars··················· 1*h*. 00*m*. 37*s*.17

By fourteen observations on *α* (Alpha) Bootis, W··· 1*h*. 00*m*. 37*s*.03

Result: Time-piece No. 1 fast of Chicago sidereal time July 3, 1858, (at 16*h*. 40*m*.)·············· 1*h*. 00*m*. 37*s*.10

By comparison: Time-piece No. 2 was slow of Chicago mean solar time (at 9*h*. 53*m*. mean time) the same night································ 4*m*. 50*s*.53

5. 1858, July 5.—At Chicago station No. 3, (see table of positions,) longitude 5*h*. 50*m*. 31*s*.2 W.

Time-piece No. 1 fast of Chicago sidereal time for this station:

By fourteen observations on *α* (Alpha) Coronæ Borealis, W································· 1*h*. 00*m*. 50*s*.08

By eighteen observations on *α* (Alpha) Andromedæ, E. 1*h*. 00*m*. 49*s*.97

Result: Time-piece No. 1 fast of Chicago sidereal time July 5, 1858 (at 19*h*. 44*m*.)·············· 1*h*. 00*m*. 50*s*.02

By comparison: Time-piece No. 2 was slow of Chicago mean solar time (at 12*h*. 48*m*.) same night·· 4*m*. 49*s*.38

6. 1858, July 7.—At Chicago station No. 2, (see table of positions,) in longitude west of Greenwich 5*h.* 50*m.* 31*s.*15.

Time-piece No. 1 fast of Chicago sidereal time for this station:	
By ten observations on *a* (Alpha) Lyræ E (at 15*h.* 32*m.*)	1*h.* 00*m.* 59*s.*98
By fifteen observations on *a* (Alpha) Bootis, W., (at 16*h.* 10*m.*)	1*h.* 00*m.* 59*s.*38
Result: Time piece No. 1 fast of Chicago sidereal time July 7, 1858, (at 15*h.* 51*m.*)	1*h.* 00*m.* 59*s.*68
By comparison: Time piece No. 2 was slow of Chicago mean solar time (at 8*h.* 48*m.* mean time) same night	4*m.* 48*s.*79

OBSERVATIONS AT MILWAUKIE.

1. *For the time.*

1858. *June* 23.—*Station:* In a vacant lot at a point 115 feet north of the parallel and 107 feet east of the meridian of the point of intersection of the middle of Milwaukie street with the middle of Mason street, equal to a difference of position of 1″.13 in latitude and 1″.44 of arc, or 0″.096 of time, in longitude.

The steeple of the Roman Catholic church on Jackson street, between Oneida and Biddle streets, is 545 feet = 5″.38 of arc in latitude north of the parallel and 557 feet, = 7″.5 of arc, or 0″.5 of time east of the meridian of this observing station. These remarks are necessary to the reduction of position hereafter to be made.

Time-piece No. 1 fast of sidereal time for this Milwaukie station—

By ten observations on *a* (Alpha) Lyræ, east	1*h.*	00*m.*	43*s.*55
By fifteen observations on *a* (Alpha) Bootis, west	1	00	42.52
Result: Time-piece No. 1 fast of sidereal time for this Milwaukie station, (at 15*h.* 55*m.* sidereal,) June 23, 1858	1	00	43

This result, and the results obtained at Chicago on the nights of the 22d and 28th of June for the time there, and for the rates of the two time-pieces during the period elapsed between these two last mentioned dates, afford the data for determining, by means of the electric telegraph, the difference of longitude between the two places.

I wovld have desired a less elapsed time for the run of chronometer No. 2 at Chicago, in getting its rate for this determination, but the duties to be performed prevented my return to Chicago sooner than the 28th of June.

The whole operation, with the result, is shown as follows, viz:

Determination of the difference of longitude between Chicago and Milwaukie, by electric signals for comparisons of time, June 23, 1858.

1. MILWAUKIE SIGNALS RECORDED AT BOTH STATIONS.

Times of signals given at Milwaukie by sidereal time-piece No. 1.	Time-piece No. 1, fast of Milwaukie sidereal time.	Times of Milwaukie signals as noted at Chicago by mean solar time-piece No 2.	Time-piece No. 2, slow of Chicago mean solar time.	Chicago correct mean solar time of Milwaukie signals.	Chicago correct sidereal time of Milwaukie signals	Milwaukie correct sidereal time of Milwaukie signals.	Difference of longitude; Milwaukie west of Chicago.
h. m s.	*h. m. s.*	*h. m. s.*	*m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
18 40 00	1 00 43.46	11 27 07.5	4 57.51	11 32 05.01	17 40 23.35	17 39 16.54	0 01 06.81
18 43 00	1 00 43.47	11 30 07	4 57.51	11 35 04.51	17 43 23.34	17 42 16.53	0 01 06.81

1st Mean. Electric fluid transmitted from Milwaukie to Chicago.................. 0*h*. 01*m*. 06.81*s*.

2. CHICAGO SIGNALS RECORDED AT BOTH STATIONS.

Times of signals given at Chicago by mean solar time-piece No. 2.	Time-piece No. 2, slow of Chicago mean solar time.	Correct Chicago mean solar time of Chicago signals.	Times of Chicago signals as noted at Milwaukie by sidereal time-piece No. 1.	Time-piece No. 1, fast of Milwaukie sidereal time.	Milwaukie correct sidereal time of Chicago signals.	Chicago correct sidereal time of Chicago signals.	Difference of longitude by each signal; Milwaukie west of Chicago.
h. m. s.	*m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
11 48 00	4 57.50	11 52 57.50	19 00 56	1 00 43.53	18 00 12.47	18 01 19.27	0 01 06.80
12 15 00	4 57.49	12 19 57.49	19 28 00.5	1 00 43.65	18 27 16.85	18 28 23.69	0 01 06.84
12 18 00	4 57.49	12 22 57.49	19 31 01	1 00 43.67	18 30 17.33	18 31 24.19	0 01 06.86
12 23 50	4 57.48	12 28 47.48	19 36 52	1 00 43.69	18 36 08.31	18 37 15.14	0 01 06.83
12 30 00	4 57.48	12 34 57.48	19 43 03	1 00 43.72	18 42 19.28	18 43 26.15	0 01 06.87
12 35 50	4 57.47	12 40 47.47	19 48 54	1 00 43.74	18 48 10.26	18 49 17.10	0 01 06.84
12 38 40	4 57.47	12 43 37.47	19 51 44.5	1 00 43.75	18 51 00.75	18 52 07.57	0 01 06.82

	h. m. s.
2d mean —Electric fluid transmitted from Chicago to Milwaukie	0 01 06.83
1st mean—Electric fluid transmitted from Milwaukie to Chicago, as above	0 01 06.81
Result: This Milwaukie station No. 1 is west of Chicago station No. 2 by a mean of the two sets of signals	0 01 06.82

	h.	m.	s.
This Milwaukie station No. 1 is west of the meridian of the steeple of the Roman Catholic church on Jackson street, (therefore subtract)			00.5
The steeple of the Roman Catholic church on Jackson street, Milwaukie, is west of the meridian of observing station No. 2 in Chicago	0	01	06.32
Chicago observing station No. 2 is west of Greenwich, (see table of positions, in Chicago)	5	50	31.15
1st determination: Longitude of the steeple of the Roman Catholic church on Jackson street, Milwaukie, west of Greenwich, by this series of observations	5	51	37.47

It will be seen that the coincidence in the results of the seven telegraphic signals sent from Chicago to Milwaukie, in the above series, is not so close as those previously given in the case of Racine, or as those which will follow at subsequent dates, as given, from Chicago to Milwaukie.

There is an extreme difference in the results of the seven sent on the 23d of June from Chicago to Milwaukie of seven one-hundredths ($\frac{7}{100}$) of a second of time. This I attribute to the little practice which the operator at Chicago had had at that date in this species of experiments.

The results from the signals sent from Milwaukie to Chicago will be found to have been exactly coincident in two of the four cases presented, which are carried out to hundredths of a second, and in the other two cases the results for difference of longitude show an extreme difference of only the one-hundredth ($\frac{1}{100}$) part of a second of time.

This may be a matter of some interest as showing how near to perfection practice may render signals, made by pressing the telegraph key with the fingers so as to make them coincident with any desired beat of a chronometer.

On the afternoon of June 30th I received a telegram which required me to go again to Milwaukie to attend to the harbor improvement there. The journey afforded another opportunity of obtaining the difference of longitude between Chicago and Milwaukie by two new sets of observations entirely independent of that already given.

On the night of the 30th of June, before starting for Milwaukie, and on the night of July 3, after my return from thence, I made, at Chicago, the observations already given under those two dates. These, combined with the observations given as follows at Milwaukie, and the telegraphic signals passed on the night of July 1 and on the day of July 3, give the two additional determinations in question.

Observations of the time at Milwaukie.

1858, *July* 1.—The night was not very favorable for observations for the time. Passing clouds frequently obscured the stars which I desired to observe near the east and west prime vertical for that object. The sky to the north and south was clearer, and hence more favorable to observations for the latitude, as will be seen further on. For the time, however, I could only get a single observation on Alpha Andromedæ in the east, to balance against five (5) observations on Alpha Bootis, and eight (8) on Alpha Coronæ Borealis, both in the west.

The observing station this night (July 1) was the centre or intersection of the public walks of the Court-house square, which I call Milwaukie station No. 2. From this point if we run due east two hundred and thirty-five (235) feet, and thence due north twenty-nine (29) feet, it will bring us perpendicularly under the apex of the steeple of the Roman Catholic church on Jackson street. Hence, this steple is 0″.29 north of the parallel, and 3.165 seconds of arc, or 0.21 second of time east of the meridian of this observing station.

Also, from the point of observation to a point perpendicularly under the centre of the dome of the court-house is due north 123 feet, equal to a difference of 1″.2 of latitude.

This night (July 1, 1858) Time-piece No. 1, fast of sidereal time for this Milwaukie station No. 2:

	h.	m.	s.
By 5 observations on Arcturus, (*α* Bootis) west········	1	01	33
By 8 observations on *α* (Alpha) Coronæ Borealis also west	1	01	32.7
	h.	m.	s.
By 13 observations on two west stars················	1	01	32.85
By 1 observation on *α* (Alpha) Andromedæ, east·······	1	01	33.31
Result: Time-piece No. 1, fast of sidereal time for this Milwaukie station No. 2, (at 19*h.* 53*m.*) July 1, 1858 ······································	1	01	33.08

From the above result, the error of time-piece No. 1 was reduced to the times of the following telegraphic signals which were passed before observing for the time. The weather was so cloudy that no observations on the stars could be obtained previous to the time of night at which the telegraph was at our disposal for these signals.

Determination of the difference of longitude between Chicago and Milwaukie, by electric signals for comparisons of time, July 1, 1858.

1. CHICAGO SIGNALS RECORDED AT BOTH STATIONS.

Times of signals given at Chicago by mean solar time-piece No. 2.	Time-piece No. 2, slow of Chicago mean solar time.	Correct Chicago mean solar time of Chicago signals.	Times of Chicago signals as noted at Milwaukie by sidereal time-piece No. 1.	Time-piece No. 1 fast of Milwaukie sidereal time.	Milwaukie correct sidereal time of Chicago signals.	Chicago correct sidereal time of Chicago signals.	Difference of longitude by each signal; Milwaukie west of Chicago.
h. m. s.	*m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
10 35 20	4 52.27	10 40 12.27	18 20 20.5	1 01 32.47	17 18 48.03	17 19 54.56	0 01 06.53
10 38 20	4 52.27	10 43 12.27	18 23 21	1 01 32 48	17 21 48.52	17 22 55.05	0 01 06.53
10 41 40	4 52.27	10 46 32.27	18 26 41.5	1 01 32.49	17 25 09.01	17 26 15.60	0 01 06.59
10 44 10	4 52.27	10 49 02.27	18 29 12	1 01 32.50	17 27 39.50	17 28 46.01	0 01 06.51

1st mean—Electric fluid transmitted from Chicago to Milwaukie.................................. 0*h* 01*m* 06*s*. 54.

2. MILWAUKIE SIGNALS RECORDED AT BOTH STATIONS.

Times of signals given at Milwaukie by sidereal time-piece No. 1.	Time-piece No. 1, fast of Milwaukie sidereal time.	Times of Milwaukie signals as noted at Chicago by mean solar time-piece No. 2.	Time-piece No. 2, slow of Chicago mean solar time.	Chicago correct mean solar time of Milwaukie signals.	Chicago correct sidereal time of Milwaukie signals.	Milwaukie correct sidereal time of Milwaukie signals.	Difference of longitude; Milwaukie west of Chicago.
h. m. s.	*h. m. s.*	*h. m. s.*	*m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
18 35 25	1 01 32.53	10 50 22	4 52.25	10 55 14.25	17 34 59.01	17 33 52.47	0 01 06.54
18 38 25.5	1 01 32.54	10 53 22	4 52.25	10 58 14.25	17 37 59.50	17 36 52.96	0 01 06.54
18 41 26	1 01 32.56	10 56 22	4 52.25	11 01 14.25	17 40 59.99	17 39 53.44	0 01 06.55
18 44 26.5	1 01 32.57	10 59 22	4 52.25	11 04 14.25	17 44 00.48	17 42 53.93	0 01 06.55

	h. m. s.
2d mean—Electric signals transmitted from Milwaukie to Chicago	0 01 06.545
1st mean—Electric signals transmitted from Chicago to Milwaukie, as above	0 01 06.540
Result—The centre of the Court-house Square at Milwaukie is west of the meridian of Chicago station No. 3, by a mean of the two sets of signals passed July 1, 1858	0 01 06.54
This Milwaukie station No. 2 is west of the meridian of the steeple of the Roman Catholic church on Jackson street, subtract	—0.21

	h.	m.	s.
Steeple of the Roman Catholic church, on Jackson street, Milwaukie, is west of the meridian of observing station No. 3, in Chicago, by the night's observations and signals of July 1, 1858	0	01	06.33
Longitude of the Chicago observing station No. 3, West of Greenwich, (see table of Chicago positions)	5	50	31.20
2d determination: Longitude of the steeple of the Roman Catholic church on Jackson street, Milwaukie, by the observations and signals of July 1, 1858	5	51	37.53

My duties in regard to Milwaukie harbor detained me there until the railroad train of the afternoon of the 3d of July. The night of July 2 was so cloudy that not a star could be seen, and a great part of the night it rained.

The 3d was clear, so I determined to try the result of a third series of telegraphic signals for the difference of longitude between Chicago and Milwaukie, which should rest for time at Milwaukie on a set of equal altitudes of the sun, observed with the sextant, a. m. and p. m.

The signals were passed by the telegraphic wires between the periods of the forenoon and afternoon observations.

I could not observe in the daytime, either in the court-house yard or at the previous station, which was occupied on the 23d of June, near the intersection of Milwaukie and Mason streets, because so many vehicles and persons on foot were constantly passing near by that the artificial horizon of quicksilver was kept constantly agitated. I was obliged, therefore, to seek a more quiet position than either of the two former stations. This I found in a vacant lot at the northeast corner of Jackson and Martin streets. This I call the Milwaukie observing station No. 3. It is eight hundred and ninety (890) feet north of the parallel and thirty-eight (38) feet east of the meridian of the steeple of the Roman Catholic church on Jackson street. Hence this steeple is eight and eight-tenths seconds (8″.8) south of the parallel, and 0″.512 of arc, =0*s*.034 of time west of the Milwaukie observing station No. 3.

1858, *July* 3.—*At Milwaukie observing station No.* 3.

[*Instruments.*—Sidereal time-piece (No. 1;) sextant of 7¼ inches radius, reading by aid of the vernier to 10 seconds of arc, and artificial horizon of quicksilver. Equal altitudes of the sun a. m. and p. m.]

Observed double altitudes of the sun's upper and lower limbs.		Times by sidereal time-piece (No. 1.)		Elapsed sidereal time	Equation of equal altitudes in sidereal time.	Time by watch of apparent noon.	Sidereal time of apparent noon.	Watch fast of sidereal time at apparent noon.
		A. M.	P. M.					
	° ′ ″	h. m. s.	h. m. s.	h. m.	s.	h. m s.	h. m. s.	h. m. s.
Upper limb	106 09 50	5 18 55.8	10 23 45.6	5 05	+2.03	7 51 22.73	6 49 42.19	1 01 40.54
Upper limb	106 58 10	5 21 17.9	10 21 23.8	5 00	2.00	7 51 22.85	----------------	1 01 40.66
Lower limb	110 23 10	5 34 34.4	10 08 07.6	4 33	1.93	7 51 22.97	----------------	1 01 40.78
Upper limb	115 28 10	5 46 56.8	9 55 45.9	4 09	1.89	7 51 23.24	----------------	1 01 41.05
Lower limb	115 28 10	5 50 12.3	9 52 29,6	4 02	+1.85	7 51 22.80	----------------	1 01 40.61

Result.—Time-piece, No. 1, fast of sidereal time for the Milwaukie observing station No. 3, at apparent noon, (say at 6*h.* 50*m.* sidereal time,) of July 3, 1858, by a mean of five pairs of equal altitudes of the sun, 1*h.* 1*m.* 40*s.*73.

After completing these observations I took the afternoon train of cars for Chicago, and arrived in time to observe there on the night of the same day, as is shown by the records already given.

The above determination of the time at Milwaukie, combined with the results of the observations given at Chicago for the 30th of June and the 3d of July, and applied to the telegraphic signals which were passed on the afternoon of the last mentioned day, between Chicago and Milwaukie, gives us a third determination of the difference of longitude between these two places.

It is as follows, viz:

Determination of the difference of longitude between Chicago and Milwaukie by electric signals for comparisons of time, July 3, 1858.

1. CHICAGO SIGNALS RECORDED AT BOTH STATIONS.

Times of signals given at Chicago by mean solar time-piece No. 2.	Time-piece No. 2 slow of Chicago mean solar time.	Correct Chicago mean solar time of Chicago signals.	Times of Chicago signals as noted at Milwaukie by sidereal time-piece No. 1.	Time-piece No. 1 fast of Milwaukie sidereal time.	Milwaukie correct sidereal time of Chicago signals.	Chicago correct sidereal time of Chicago signals.	Difference of longitude by each signal; Milwaukie west of Chicago.
h. m. s.	*m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
1 11 00	4 51.06	1 15 51.06	9 02 28.5	1 01 41.01	8 00 47.49	8 01 53.76	0 01 06.27
1 14 30	4 51.06	1 19 21.06	9 05 59.0	1 01 41.02	8 04 17.98	8 05 24.33	0 01 06.35
1 17 10	4 51.06	1 22 01.06	9 08 39.5	1 01 41.03	8 06 58.47	8 08 04.77	0 01 06.30
1 20 00	4 51.06	1 24 51.06	9 11 30.0	1 01 41.05	8 09 48.95	8 10 55.23	0 01 06.28

1st mean—Electric signals sent from Chicago to Milwaukie.. 0 01 06.30

2. MILWAUKIE SIGNALS RECORDED AT BOTH STATIONS.

Times of signals given at Milwaukie by sidereal time-piece No. 1.	Time-piece No. 1 fast of Milwaukie sidereal time.	Times of Milwaukie signals as noted at Chicago by mean solar time-piece No. 2.	Time-piece No. 2 slow of Chicago mean solar time.	Chicago correct mean solar time of Milwaukie signals.	Chicago correct sidereal time of Milwaukie signals.	Milwaukie correct sidereal time of Milwaukie signals.	Difference of longitude; Milwaukie west of Chicago.
h. m. s.	*h. m. s.*	*h. m. s.*	*m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
9 17 35.0	1 01 41.07	1 26 04.	4 51.05	1 30 55.05	8 17 00.22	8 15 53.93	0 01 06.29
9 20 35.5	1 01 41.08	1 29 04.	4 51.05	1 33 55.05	8 20 00.71	8 18 54.42	0 01 06.29
9 23 36.0	1 01 41.09	1 32 04.	4 51.05	1 36 55.05	8 23 01.20	8 21 54.91	0 01 06.29
9 26 36.5	1 01 41.10	1 35 04.	4 51.05	1 39 55.05	8 26 01.69	8 24 55.40	0 01 06.29

	h. m. s.
2d mean—Electric signals sent from Milwaukie to Chicago	0 01 06.29
1st mean—Electric signals sent from Chicago to Milwaukie, given above	0 01 06.30
Result.—Milwaukie observing station No. 3 is west of the meridian of the Chicago station No. 3, by a mean of the two sets of signals passed in the afternoon of July 3, 1858	0 01 06.3

	h.	*m.*	*s.*
Brought forward	0	01	06.3
The steeple of the Roman Catholic church on Jackson street is west of the Milwaukie observing station No. 3			+0.03
Hence the steeple of this Roman Catholic church at Milwaukie is west of the meridian of the Chicago observing station No. 3, by this third determination made July 3, 1858	0	01	06.33
Longitude of the Chicago observing station No. 3, west of the meridian of Greenwich	5	50	31.20
3*d determination:* Longitude of the steeple of the Roman Catholic church on Jackson street, Milwaukie, west of the meridian of Greenwich, by this third determination made July 3, 1858	5	51	37.53

Late in the afternoon of the 5th of July I was again summoned to Milwaukie to give some special directions there in regard to the operations of the United States steam dredge, and the repairs required to keep her in good working order. I consequently left Chicago for that place on the morning of July 6, and returned to Chicago by the afternoon rail-train of July 7. On the night before I started on this journey I made the observations for the time at Chicago, reported in a previous part of this paper under the date of July 5. After my return I made, on the night of July 7, those which are reported under that date. These two results give the rates of both time-pieces during the interval of time, which was forty-four (44) mean solar hours, and also the means of reducing the time at Chicago to the period of the telegraphic signals which were passed between that place and Milwaukie on the night of the 6th of July.

After the duties of the day were over at Milwaukie, I made, at night, the following observations for the time at the same station which was occupied for observing the equal altitudes of the sun on the 3d of July. It is called Milwaukie observing station No. 3.

Two sets of time observations were made at this station on the night of July 6, one set before exchanging the telegraphic signals with Chicago, and another set after the said signals. The mean of the two results was adopted for the mean period of the two, which corresponds nearly (within half an hour) with the mean period of the signals, and thus leaves but half an hour's run of time-piece No. 1 between the moment of getting its error from observation and the mean period of the signals.

Observations for the time at Milwaukie, made in the night of July 6, 1858, *at Milwaukie station No.* 3.

1*st set; before the telegraphic signals:* Time-piece No. 1, fast of sidereal time for this station:

	h.	m.	s.
By 12 observations on *a* (Alpha) Lyræ, E., (at 15*h.* 39*m.* sidereal)	1	02	01.19
By 13 observations on *a* (Alpha) Bootis, (Arcturus,) W., (at 16*h.* 04*m.* sidereal)	1	02	00.15
1*st result.—Before telegraphic signals:* Time-piece No. 1, fast of sidereal time for Milwaukie station No. 3, at 15*h.* 52*m.* sidereal, of July 6, 1858	1	02	00.67

2*d set; after the telegraphic signals:* Time-piece No. 1 fast of sidereal time for this station:

	h.	m.	s.
By 5 observations on *a* (Alpha) Coronæ Borealis, W., (at 20*h.* 08*m.*)	1	02	01.83
By 5 observations on *a* (Alpha) Andromedæ, E., (at 20*h.* 22*m.*)	1	02	00.94
2*d result.—After telegraphic signals:* Time-piece No. 1 fast of sidereal time for Milwaukie station No. 3, at 20*h.* 15*m.*, sidereal of July 6, 1858	1	02	01.38
Do. do. at 15*h.* 52*m.* sidereal, before the signals, as above	1	02	00.67
Result adopted.—Time-piece No. 1 fast of sidereal time for Milwaukie observing station No. 3, at 18*h.* 03*m.*, sidereal, of July 6, 1858	1	02	01.00

The above result, combined with the results for the time at Chicago, as derived from the observations of July 5 and July 7, already given, and the telegraphic signals which were exchanged between the two places on the night of July 6, give us a fourth (4th) determination of the difference of longitude between Chicago and Milwaukie entirely independent of the other three, as follows, viz:

Determination of the difference of longitude between Chicago and Milwaukie by electric signals for comparisons of time, July 6, 1858.

1. CHICAGO SIGNALS RECORDED AT BOTH STATIONS.

Times of signals given at Chicago by mean solar time-piece No. 2.	Time-piece No. 2, slow of Chicago mean solar time.	Correct Chicago mean solar time of Chicago signals.	Times of Chicago signals, as noted at Milwaukie by sidereal time-piece No. 1.	Time-piece No. 1 fast of Milwaukie sidereal time.	Milwaukie correct sidereal time of Chicago signals.	Chicago correct sidereal time of Chicago signals.	Difference of longitude by each signal — Milwaukie west of Chicago.
h. m. s.	*m. s.*	*h. m. s.*	*h m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
10 00 20	4 49.1	10 05 09.1	18 05 23.0	1 02 00.78	17 03 22.22	17 04 28.42	0 01 06.20
10 03 20	4 49.1	10 08 09.1	18 08 23.5	1 02 00.79	17 06 22.71	17 07 28.91	0 01 06.20
10 06 20	4 49.1	10 11 09.1	18 11 24.0	1 02 00.80	17 09 23.20	17 10 29.41	0 01 06.21
10 09 20	4 49.1	10 14 09.1	18 14 24.5	1 02 00.81	17 12 23.69	17 13 29.90	0 01 06.21
10 12 10	4.49.1	10 16 59.1	18 17 15.0	1 02 00.82	17 15 14.18	17 16 20.37	0 01 06.19

1st mean—Electric fluid transmitted from Chicago to Milwaukie, 0*h.* 01*m.* 06*s.* 202.

2. MILWAUKIE SIGNALS RECORDED AT BOTH STATIONS.

Times of signals given at Milwaukie by sidereal time-piece No. 1.	Time-piece No. 1, fast of Milwaukie sidereal time.	Times of Milwaukie signals, as noted at Chicago by mean solar time-piece No. 2.	Time-piece No. 2, slow of Chicago mean solar time.	Chicago correct mean solar time of Milwaukie signals.	Chicago correct sidereal time of Milwaukie signals.	Milwaukie correct sidereal time of Milwaukie signals.	Difference of longitude; Milwaukie, west of Chicago.
h. m. s.	*h. m s.*	*h. m. s.*	*m. s.*	*h. m. s.*	*h m. s.*	*h. m. s.*	*h. m. s.*
18 23 15	1 02 00.85	10 18 09	4 49.09	10 22 58.09	17 22 20.34	17 21 14.15	0 01 06.19
18 26 15	1 02 00.86	10 21 08.5	4 49.09	10 25 57.59	17 25 20.33	17 24 14.14	0 01 06.19
18 29 16	1 02 00.87	10 24 09	4 49.09	10 28 58.09	17 28 21.32	17 27 15.13	0 01 06.19
18 32 16.5	1 02 00.88	10 27 09	4 49.09	10 31 58.09	17 31 21.82	17 30 15.62	0 01 06.20
18 35 17	1 02 00.89	10 30 09	4 49.09	10 34 58.09	17 34 22.31	17 33 16.11	0 01 06.20

	h. m. s.
2d Mean.—Electric fluid transmitted from Milwaukie to Chicago	0 01 06.194
1st Mean.—Electric fluid transmitted from Chicago to Milwaukie, as before	0 01 06.202
Result.—Milwaukie station No. 3 is west of the meridian of the Chicago observing station No. 3, by a mean of the two sets of telegraphic signals passed on the night of July 6, 1858	0 01 06.2

— 8

To reduce to the steeple of the Roman Catholic church on Jackson street, as before	+0.03
Hence, the steeple of this church at Milwaukie is west of the meridian of the Chicago observing station No. 3, by this fourth determination, of July 6, 1858	0 01 06.23
Longitude of Chicago observing station No. 3, west of the meridian of Greenwich	5 50 31.2
4th determination.—Longitude of the steeple of the Roman Catholic church on Jackson street, Milwaukie, west of the meridian of Greenwich	5 51 37.43

Recapitulation of the four determinations of the longitude of Milwaukie, Wisconsin.

They are all referred to the steeple of the Roman Catholic church on Jackson street.

	h.	*m.*	*s.*
1. Determination of June 23, 1858	5	51	37.47
2. Determination of July 1, 1858	5	51	37.53
3. Determination of July 3, 1858	5	51	37.53
4. Determination of July 6, 1858	5	51	37.43
Mean.—Longitude of the steeple of the Roman Catholic church on Jackson street, Milwaukie, west of the meridian of Greenwich	5	51	37.5
Longitude in arc	87°	54′	22.″5

Rates of the time-pieces, derived from the observations made at Chicago.

1. *The rate of the sidereal time-piece No. 1.*

From—	To—	Elapsed sidereal interval.	Rate per 24 sidereal hours.
		Days and decimals.	Gaining.
			s.
June 22, 1858	June 28, 1858	6.000	+ 6.14
June 28, 1858	June 30, 1858	2.162	+ 6.15
June 30, 1858	July 3, 1858	2.870	+ 5.66
July 3, 1858	July 5, 1858	2.127	+ 6.07
July 5, 1858	July 7, 1858	1.837	+ 5.27
Sept. 5, 1858	Sept. 7, 1858	2.079	+ 6.00

2. *Rate of the mean solar time-piece No. 2.*

From—	To—	Elapsed mean solar interval.	Rate per 24 mean solar hours.
		Days and decimals.	+ Gaining. — Losing.
			s.
June 22, 1858	June 28, 1858	5.983	+ 0.76
June 28, 1858	June 30, 1858	2.155	+ 0.30
June 30, 1858	July 3, 1858	2.860	+ 0.90
July 3, 1858	July 5, 1858	2.120	+ 0.54
July 5, 1858	July 7, 1858	1.833	+ 0.32
Sept. 5, 1858	Sept. 7, 1858	2.064	+ 0.07

The latitude of Milwaukie.

This was observed on the night of July 1, 1858, at Milwaukie station No. 2, or the centre of the court-house square; and also on the night of July 6, 1858, at Milwaukie station No. 3, already described. Both nights' observations are reduced to the steeple of the Roman Catholic church on Jackson street.

Observations.

July 1, 1858.—At Milwaukie station No. 2, in the centre of the court-house square.

Latitude of station.

By 18 circum-meridian altitudes of *α* (Alpha) Aquilæ, S.	43° 02′ 30″.2
By 12 altitudes of Polaris, (*α* Ursæ Minoris,) N	43° 02′ 36″.8
Result.—Latitude of station	43° 02′ 33″.5
Reduction to steeple of Roman Catholic church on Jackson street	+ 0″.29
Latitude of the steeple, deduced from this night's observations	43° 02′ 33″.79

July 6, 1858.—At Milwaukie station No. 3, already described.

Latitude of station.

By 17 altitudes of Polaris, (*α* Ursæ Minoris,) N	43° 02′ 39″.12
By 26 circum-meridian altitudes of *α* (Alpha) Aquilæ, S.	43° 02′ 45″.77
Result.—Latitude of station	43° 02′ 42″.45
Reduction to the steeple of the Roman Catholic church on Jackson street	— 8″.8

Latitude of this steeple by the observations of July 6, 1858 .... 43° 02′ 33″.65
Latitude by the observations of July 1, 1858, above given .... 43° 02′ 33″.79

Final result.—Latitude of the steeple of the Roman Catholic church on Jackson street, Milwaukie ..... 43° 02′ 33″.7
Longitude of the steeple of the Roman Catholic church on Jackson street, Milwaukie, as above given, W. of the meridian of Greenwich .... 5*h.* 51*m.* 37.5*s.* = 87° 54′ 22″.5

From the two last expressed data, and the measurements made along the streets, we present the following table of latitudes and longitudes of positions in Milwaukie, viz:

Positions in Milwaukie.	Latitude north.	Longitude west of Greenwich.	
		In arc.	In time.
	° ′ ″	° ′ ″	*h.* *m.* *s.*
1. The dome of the court-house	43 02 34.6	87 54 25.66	5 51 37.71
2. The centre of the court-house public square.	43 02 33.4	87 54 25.66	5 51 37.71
3. The steeple of the Roman Catholic church on Jackson street	43 02 33.7	87 54 22.5	5 51 37.5
4. The intersection of the middle of Milwaukie street with the middle of Mason street.	43 02 27.2	87 54 31.4	5 51 38.1
5. The light-house	----------	----------	----------
6. The beacon light at the end of the north harbor pier	----------	----------	----------

It has been shown above that the positions of the court-houses of Racine and Milwaukie are as follows, viz:

	Latitude north.	Longitude west of Greenwich.
	° ′ ″	° ′ ″
Dome of the Racine court-house	42 43 44.6	87 47 04
Dome of the Milwaukie court-house	43 02 34.6	87 54 25.66
Difference.—Milwaukie + (plus) both in latitude and longitude	18 50.	7 21.66

Hence, the distance from the court-house of Racine to the court-house of Milwaukie, measured in the direct or shortest line on the spheroid, is 22.546 miles on an azimuth of N. 15° 59′ 19″ W.

The azimuth back from Milwaukie to Racine is S. 16° 04′ 19″.5 E.

Assuming this determination as a base, and allowing for the contour of the coast-line, we make the navigable distance from Racine harbor to Milwaukie harbor twenty-five and two-thirds (25⅔) miles.

B 1.—MILWAUKIE HARBOR, WISCONSIN.

Statement of the number of cubic yards of earth excavated and removed by the United States steam dredge and scows for improving the new harbor at the north cut at Milwaukie, between the 1*st of October*, 1857, *and the* 27*th of July*, 1858.

[The whole of this excavation was done in the new or north cut at the west end of the channel formed by the new piers, in order to open a communication with Milwaukie river.]

Date.		No. cubic yards.	Date.		No. cubic yards.
	1857.			1858.	
October	1	600	May	25	260
	5	440		26	380
	6	520		27	260
	7	600		28	100
	8	580		29	300
	9	520	June	1	480
	10	520		2	520
	12	500		4	440
	13	600		5	420
	14	520		7	480
	15	280		8	520
	17	340		9	540
	18	360		11	480
	20	400		12	580
	21	420		14	700
	22	560		15	660
	23	600		16	620
	24	480		17	660
	26	520		18	460
	27	500		19	760
	28	560		21	480
	29	520		22	700
	30	560		23	700
	31	600		24	360
November	2	600		25	480
	4	520		26	520
	5	480		28	580
	6	560		29	420
	9	400		30	400
	10	500	July	1	420
	11	600		2	480
	12	560		3	500
	13	400		6	320
	14	520		7	380
	16	600		8	360
	17	560		9	460
	18	600		10	500
	1858.			12	640
May	8	400		13	680
	12	500		15	640
	13	620		16	620
	14	620		17	620
	15	580		19	540
	18	400		20	640
	19	460		21	540
	20	520		22	580
	21	400		24	440
	22	580		26	680
	24	400		27	340
Total number of cubic yards excavated and removed by the United States steam dredge and her scows for the improvement of Milwaukie new harbor, between October 1, 1857, and July 27, 1858					49,120

RECAPITULATION,

Showing the quantity of earth excavated and removed by the United States steam dredge and scows for the improvement of the new harbor at Milwaukie during the whole of the working seasons of 1857 *and* 1858.

	Cubic yards.
1. Quantity dredged and removed from the channel between the new piers, from June 26 to September 22, 1857, as per statement B 2, at page 70 of Senate (executive) document No. 42, of the 35th Congress, 1st session.	14,260
2. Quantity dredged and removed from the Middle Ground, in Milwaukie river, west of the new or north cut, from July 16 to September 30, 1857, as per same statement, continued at page 71 of the same Senate document, No. 42	18,144
3. Quantity dredged and removed from the new or north cut, to open a free communication between the channel formed by the new piers and Milwaukie river, from October 1 to November 18, 1857, and from May 8 to July 27, 1858, now first reported	49,120
Aggregate quantity dredged and removed by the United States steam dredge and scows in 1857 and 1858, for the improvement of the new harbor at Milwaukie, Wisconsin.	81,524

J. D. GRAHAM,
Major U. S. T. Engineer Corps, Bvt. Lieut. Colonel,
Superintending Engineer of Lake Harbor Works.

OFFICE GENERAL SUPERINTENDENCE LAKE HARBOR WORKS,
Chicago, November 15, 1858.

B 2.

Estimate of the cost of repairing the breach in the land strip separating the lower part of Milwaukie river from Lake Michigan.

This will require eight cribs, each 32 feet long, 10 feet wide, and of an average height of 4 feet from bottom to the water surface, or 9 feet high from bottom to top. It is proposed to build them after the specifications given in table T 1, printed at pages 12 to 15 of Senate (executive) document No. 16, of the 34th Congress, 3d session, making due allowance for the diminished width of 10 feet, instead of 20 feet, which is provided for in table T 1.

Estimate for one crib.

For 1,020 lineal feet of pine timber, hewn or sawed, one foot square, at 16 cents per lineal foot	$163 20
For 741 feet, board measure, of oak plank, 3 inches thick, for flooring, at $18 per thousand	13 34
For 917 pounds of wrought iron, one inch square, for bolts, at 4 cents per pound	36 68
For 68 pounds of wrought iron spikes, $\frac{3}{8}$ by $\frac{3}{8}$ square, at $7\frac{1}{2}$ cents	7 30
For 13 cords of ballast stone, at $9 per cord	117 00
For carpentry, labor, and superintendence	150 00
Sum	487 52
Add ten per cent. for contingencies	48 75
Estimated cost of one crib	536 27
Then, eight cribs, at $536 27, give for the repair of this breach	4,290 16

J. D. GRAHAM,
Major Top'l Eng'rs, Bvt. Lieut. Col., Superintending Engineer.

OFFICE GENERAL SUPERINTENDENCE LAKE HARBOR WORKS,
Chicago, November 15, 1858.

6. SHEBOYGAN HARBOR, WISCONSIN.

There have been no funds at my disposal for this harbor since August, 1856. Only a very small balance was in hand after July of that year. It was expended in making a survey of the harbor, and the map projected from it, marked G No. 45, is in the Topographical Bureau, and a copy is in the archives of the United States Senate.

Having no means to make any more recent examinations of this harbor, I must refer to that map and the estimates heretofore submitted in detail for its completion, amounting to $36,614 55.

For details of items, and for an account of the commerce of this harbor, I beg leave to refer to my estimates and statements, to be found printed at pp. 252 to 288, and at pp. 342 and 343, of Senate Ex. Doc. No. 16, of the 34th Congress, 3d session.

I offer the estimates therein contained as my estimates for this year, and I would recommend that the whole be granted in one appropriation.

7. MANITOWOC HARBOR, WISCONSIN.

The appropriation of 1852 for this work—the only one ever made—was exhausted, as heretofore reported, in the working season of 1854. No work has, therefore, been done at this harbor since that time. A survey of the harbor was made under my direction in August, 1856.

The map projected from it, marked G No. 46, is in the Topographical Bureau, and a copy is in the archives of the United States Senate.

In regard to this harbor, I must refer to the statements and estimates contained in my previous reports, to be found printed at pp. 288 to 300, and 343 to 344, of the last mentioned Senate document.

I renew here the estimates therein contained, amounting to $62,780 94.

I recommend that this sum be granted in two annual appropriations, as follows, viz:

The first year	$40,000 00
The second year	22,780 94
Total, as before	62,780 94

8. MICHIGAN CITY BREAKWATER, INDIANA.

No work has been carried on here since 1855, for the reason that the appropriation of 1852 was expended, as heretofore reported, in a vain attempt to commence the breakwater, in accordance with a plan entirely too contracted for a work of this kind on Lake Michigan. which should be of a capacity and durability to afford protection as a harbor of refuge or safe anchorage for the shipping of the lakes generally which are in trade with the ports of Lake Michigan. It is in this point that any breakwater on this lake should be viewed commercially. As a place of refuge from the lake gales, such a work would be indispensable in time of war for our armed ships.

As it seems unnecessary for me to reiterate here all that I have heretofore presented for consideration on this subject, I beg to refer to my previous reports, printed at pp. 344 to 374 of Senate Ex. Doc. No. 16, of the 34th Congress, 3d session; also at pp. 76 (last paragraph) to 77, of Senate Ex. Doc. No. 42, of the 35th Congress, 1st session.

I recommend here the estimates therein presented for this work.

As there was no money to carry on this work, I was obliged, in June last, under the regulation of the War Department, to turn over a quantity of timber and tools appertaining to it to another public work under my direction, according to a valuation fixed by a board of survey. The timber was becoming injured by the effect of time, and would not bear to be kept another season.

The balance remaining on hand of the proceeds of this sale on the 30th of September, 1858, was eighty-two dollars and seventy-six and one-fourth cents, say $82 76¼.

This is in course of expenditure in making a new survey here, which is indispensable to a revised plan for this work.

9. NEW BUFFALO HARBOR, MICHIGAN.

No work has been done at this harbor for the want of means, as heretofore reported. A minute survey was made of this harbor in

September, 1857. The resulting map, marked G No. 54, was sent in duplicate to the Topographical Bureau. A copy is in the archives of the United States Senate.

For full information respecting the character of this place, and its susceptibility of improvement, so as to make a good harbor, I beg leave to refer to my last annual report printed, from p. 74 to p. 82 of Senate Ex. Doc. No. 42, of the 35th Congress, 1st session.

I herewith present the estimates, reiterated from last year. They are as follows, viz:

Estimate C 1.

For a harbor to suit the local trade	$98,113 47

Estimate C 2.

For a harbor to serve both the purposes of a harbor of refuge for the lake commerce and for the local trade, $~~176~~,607 79. 167,

I would recommend that this last mentioned sum be granted, as adopting the most useful of the two plans of improvement, and that it be granted in three annual appropriations, as follows, viz:

The first year	$60,000 00
The second year	53,803 90
The third year	53,803 89
Total, as per estimate C 2	167,607 79

C 1.

NEW BUFFALO HARBOR, MICHIGAN.

Estimate of the cost of constructing a harbor at New Buffalo, Michigan, of a capacity to suit the present local trade of the place and the smaller class of vessels navigating Lake Michigan.

1. THE HARBOR PIERS.

These will be required to project 600 feet from the shore into the lake; each pier will, therefore, require 20 cribs, or 40 cribs for both piers, each 30 feet long, 25 feet wide, and 15 feet high from bottom to top, and 10 feet high from bottom to the surface of the water, to be constructed according to the drawings in sheet G No. 21, in the Topographical Bureau, and the tables marked T 3, at pages 18 to 21, of Senate Ex. Doc. No. 16, of the 34th Congress, 2d session.

The cost of each crib will be as follows:

For 1,813½ lineal feet of pine timber, hewn or sawed, 1 foot square, at 18 cents per lineal foot	$326 43
For 927½ lineal feet of white oak timber, hewn or sawed, 1 foot square, at 22 cents per lineal foot	204 05

For 1,728 feet, board measure, of white oak plank, in pieces 24 feet long by eight inches wide, and three inches thick, at $20 per M	$34 56
For 4,196⅓ pounds of wrought iron, round in form, and 1½ inch in diameter, for bolts, at 4 cents per pound	167 85
For 126.8 pounds of wrought iron spikes, ⅜ by ⅜ of an inch square and 6 inches long, headed and pointed, at 7½ cents per pound	9 51
For 55 cords of hard boulder stone, for crib ballast, at $10 per cord	550 00
Cost of material for one crib	1,292 40
For carpentry, labor, hauling, and superintendence	350 00
Sum	1,642 40
Add 10 per cent. for contingencies	164 24
Estimated cost of each crib	1,806 64
Then, 40 cribs, at $1,806 64 each, will cost for the two piers	72,265 60

2. FOR THE DREDGING TO OBTAIN TEN FEET DEPTH OF WATER BETWEEN THE PIERS.

This will require the excavation and removal of the following quantity of sand, viz:

38,666 cubic yards, at 14 cents per cubic yard	$5,413 24

3. FOR THE THOROUGH CUT BETWEEN LAKE MICHIGAN AND POTTAWATOMIE LAKE.—(*See map G No.* 54.)

This cut will be 460 feet long by 302 feet wide at the water surface. The greatest elevation of the cut is 12 feet above the water level. The average elevation is, however, only 4.8 feet. It is proposed to give the sides of this cut a slope of 2 base to 1 perpendicular. At this slope the soil will stand if sown with grass seed, and thus covered with grass.

The number of cubic yards to be removed from this portion of the cut will be as follows, viz:

25,491 cubic yards of sand, at 15 cents per cubic yard	$3,823 65
Then, for a cut with perpendicular sides, 302 feet wide and 10 feet deep, and 460 feet long, will require as follows, viz: 51,451 cubic yards of sand to be removed by dredging, at 6 cents per cubic yard, as it will be purchased for filling on the fronts of water lots at a price which will leave 6 cents per cubic yard as the net cost of dredging	3,087 06
Estimated cost of the excavation for the thorough cut, to a depth of 10 feet below the level of the lake surface	6,910 7

4. FOR PROTECTING THE SIDES OF THE THOROUGH CUT FROM ABRASION.

This will require an oak pile, 1 foot square and 27 feet long, to be driven at every 10 feet apart, to which oak caps and stringers are to be bolted, and then the spaces filled by driving sheath piles 27 feet long by 8 to 10 inches wide and 4 inches thick, to be bolted to the caps and stringers, these piles to be driven 10 feet into the soil.

Then, for both sides of the cut there will be required as follows, viz:

For 92 white oak piles, each 27 feet long and 1 foot square = 2,484 cubic feet of white oak, at 25 cents per cubic foot	$621 00
For driving ninety-two white oak piles, at $2 50 each	230 00
For 920 lineal feet of white oak caps, one foot square, at twenty-two cents per lineal foot	202 40
For 920 lineal feet of white oak stringers, to be placed two feet above the water line, at twenty-two cents	202 40
For 368 wrought iron bolts, each twenty inches long, of one and a half inch diameter, round wrought iron = 613 lineal feet, weighing 5.972 pounds per foot = 3,661 pounds, at four cents per pound	146 44
For 89,424 feet, board measure, of white oak sheath piling, in pieces twenty-seven feet long and four inches thick, at twenty-five dollars per M	2,235 60
For driving 828 sheath piles, at one dollar each	828 00
For 3,312 wrought iron spikes for fastening the sheath piles to the caps and stringers, each nine inches long and three-fourths by three-fourths of an inch square, weighing 1.493 pounds per lineal foot, or 1.12 pounds per spike = 3,709 pounds, at six cents per pound	222 54
4. Estimated cost of protecting the sides of the channel through the thorough cut	4,688 38

5. FOR DREDGING A BASIN IN POTTAWATOMIE LAKE.

For a harbor on the scale above described, a basin, 1,420 feet long by 700 feet wide, limited by the dotted lines A B, B C, C D, D A, drawn upon map G No. 54, if dredged to a depth of twelve feet below the present lake surface, would suffice. The area of such a basin would be 110,444 square yards, or 22.8 acres.

The average depth of water now existing here is four feet, but the lake is now about three and a half feet higher than its low water stage. The depth of excavation in the soil would then be eight feet, and the quantity of soil to be removed 294,518 cubic yards.

It is stated in the report of Mr. Berrien, before alluded to, that this soil is so soft that it can be removed by a dredging machine at a cost of three (3) cents per cubic yard.

Our own survey, made in September, 1857, corroborates this statement as correct.

5. Then, 294,518 cubic yards, at three cents per yard.. $8,835 54

The owners of lots fronting on this basin would erect lines of sheath piling on its borders at their own expense, within which they would be glad to receive the excavated stuff for filling up lots to required grades, and thus it would be secured against being carried back into the basin.

Recapitulation of items in estimate C 1.

1. For two parallel piers, 600 feet long, each, and 300 feet apart	$72,265 60
2. For dredging between these piers to obtain a depth of ten feet of water	5,413 24
3. For excavation to form the thorough cut	6,910 71
4. For piling to protect the sides of the thorough cut from abrasion	4,688 38
5. For dredging a basin in Pottawatomie lake, 1,420 feet long by 700 feet wide, to produce twelve feet depth of water	8,835 54
Amount of estimate C 1	98,113 47

J. D. GRAHAM,
Major Top'l Eng'r Corps, Bt. Lieut. Col., Supt'g Eng'r.

OFFICE GEN. SUP. OF LAKE HARBOR WORKS,
Chicago, November 15, 1858.

C 2.

Estimate of the cost of constructing a harbor at New Buffalo, Michigan, suitable for the accommodation as a harbor of refuge of the largest class of mercantile vessels navigating Lake Michigan.

For such a harbor the piers should reach to a depth of sixteen (16) feet of water in Lake Michigan, and the west pier would, in that case, be eight hundred and ten (810) feet long, and the east pier would be seven hundred and fifty (750) feet long, and their interior faces would be three hundred (300) feet apart. It is proposed to construct these piers in accordance with the drawings in sheet G No. 21, and the specifications in table T 3, contained in my report No. 116, of December 31, 1856, to be found at pages 18 to 21 of Senate Ex. Doc. No. 16, of the 34th Congress, 3d session; the depth of water between the piers to be thirteen (13) feet.

The thorough cut, to communicate with Pottawatomie lake, will be the same as in estimate C 1, except that the depth of its water prism should be thirteen (13) feet, instead of ten (10) feet.

The interior basin in Pottawatomie lake should be 2,450 feet long by 700 feet wide, corresponding to the figure E F G H, drawn in dotted lines on the map G No. 54, and it should be thirteen feet deep.

The estimate of these several items will then be as follows, viz:

1. THE HARBOR PIERS.

These will require 27 cribs for the west pier and 25 for the east pier, or 52 cribs for both piers, each 30 feet long, 25 feet wide, and of an average depth from top to bottom of 18 feet, or 13 feet from the water line to the soil at bottom.

The cost of one crib will be as follows, viz:

For 3,236 lineal feet of white oak timber, hewn one foot square, at 22 cents per lineal foot	$711 92
For 1,728 feet, board measure, of white oak plank, three inches thick, for flooring, at $20 per thousand	34 56
For 5,074 pounds of round wrought iron, for bolts, 1½ inch in diameter, at 4 cents per pound	202 96
For 127 pounds of wrought iron spikes, ⅜ by ⅜ of an inch square, pointed and headed, at 7½ cents per pound	9 52
For 67⅕ cords of hard boulder stone, for crib ballast, at $10 per cord	672 00
Estimated cost of materials for one crib	1,630 96
For carpentry, labor, superintendence, &c	500 00
Add ten per cent. on the above for contingencies	213 09
Estimated cost of one crib	2,344 05
(1.) Then, 52 cribs, at $2,344 05 each, equals for the cost of the two piers	$121,890 50

2. FOR THE DREDGING TO OBTAIN THIRTEEN FEET DEPTH OF WATER BETWEEN THE PIERS.

This will require the excavation and removal of the following quantity of sand, viz:

(2.) 60,141 cubic yards, at 14 cents per cubic yard	$8,419 74

3. FOR THE THOROUGH CUT BETWEEN LAKE MICHIGAN AND POTTAWATOMIE LAKE.—*(See map G No. 54.)*

The first item under this head will be the same as it is under the third head in estimate C 1, namely:

Cutting to the depth necessary to reach the level of the water surface

25,491 cubic yards of sand, at 15 cents per cubic yard	$3,823 65
Then, for a channel with perpendicular sides, 302 feet wide, 460 feet long, and 13 feet deep, there will be required to be excavated 66,887 cubic yards, at six cents per cubic yard	4,013 22
(3.) Estimated cost of a thorough cut, with a water prism 13 feet deep	7,836 87

4. FOR PROTECTING THE SIDES OF THE CHANNEL IN THE THOROUGH CUT FROM ABRASION.

This will be the same as the item under the fourth head of the estimate marked C 1, viz	$4,688 38

5. FOR DREDGING A BASIN IN POTTAWATOMIE LAKE.

This basin should be of sufficient capacity to accommodate, as a harbor of refuge, the general mercantile marine of Lake Michigan, and also our national armed ships in time of war. The depth for the mercantile marine need not be greater than thirteen feet, and our estimate is therefore based on that depth. It may easily, and in a few weeks, be increased to twenty feet of depth to accommodate ships of war. The depth between the piers would, in such an event, have to be similarly increased by dredging. The dredging would be done by the steam dredge belonging to Lake Michigan.

Then, an excavation 2,450 feet long by 700 feet wide, and 13 feet deep, will require the removal by the dredging machine of the following quantity of this soft mud, viz: 825,740 cubic yards, at three cents per cubic yard, $24,772 20.

Recapitulation of items in estimate C 2.

1. For two parallel piers, the west being 810 feet long and the east 750 feet long, each 25 feet wide and 300 feet apart	$121,890 60
2. For dredging to produce a depth of 13 feet of water between these piers	8,419 74
3. For the excavation to form the thorough cut, with a water prism 13 feet deep	7,836 87
4. For protecting, by close piling, the sides of the channel in the thorough cut against abrasion	4,688 38
5. For dredging a basin in Pottawatomie lake, 2,450 feet long by 700 feet wide, and 13 feet deep	24,772 20
Amount of estimate C 2	167,607 79

J. D. GRAHAM,
Maj. Top. Eng. Corps, Bvt. Lieut. Col., Sup'g Eng'r.

OFFICE GENERAL SUPERINTENDENCE LAKE HARBOR WORKS,
Chicago, November 15, 1858.

10. ST. JOSEPH'S HARBOR, MICHIGAN.

This harbor is in a much worse condition now than ever before reported. From the breaking in of the lake sea through the rotten piers, fully described in my previous reports, the channel is much diminished in depth.

I ask a reference to my reports upon this very important lake harbor, printed in Senate (Ex.) Doc. No. 16, of the 34th Congress, 3d session, from p. 379 to p. 385, and in Senate (Ex.) Doc. No. 42, at pp. 82 to 84. 35 Cong. 1 Sess.

I beg leave to renew the estimate for this work, given at page 83 of the last mentioned document, amounting to the sum of $97,633 91.

I recommend now that the whole of this sum be granted in one appropriation, as I consider this measure necessary to save this harbor from ruin.

I would refer to the maps, G No. 47 and G No. 55, now in the Topographical Bureau and in the archives of the Senate, for a full understanding of the importance of this harbor, and of its present dilapidated condition.

11. BLACK LAKE HARBOR, MICHIGAN.

In regard to the importance of this improvement, I beg leave to refer to my previous reports, printed at pp. 386 and 387 of Senate (Ex.) Doc. No. 16, of the 34th Congress, 3d session, and at pp. 84 to 89 of Senate (Ex.) Doc. No. 42, of the 35th Congress, 1st session.

I renew the estimates contained in full detail at pp. 87 to 89 of the last mentioned document. They amount to $128,343 02.

I recommend that the amount be granted in three equal annual appropriations, each of $42,781.

In regard to this harbor, I will refer to map G No. 48, now in the Topographical Bureau and in the archives of the United States Senate.

12. GRAND RIVER HARBOR, MICHIGAN.

This was always regarded as one of the most important harbors on the eastern coast of Lake Michigan, and from the connexion by railroad with Detroit, lately completed, and the further connexion with Milwaukie by steam vessels, it has become one of the most important on Lake Michigan. These connexions were completed in October of the present year. They have created a link of vast trade between the old northern and the new western States.

For a full exposition of the importance of this harbor, and of its great susceptibility of improvement, I beg leave to refer to map G No. 49, now in the Topographical Bureau and in the archives of the United States Senate, and also to my annual report for 1857, printed at pp. 89 to 95 of Senate (Ex.) Doc. No. 42 of the 35th Congress, 1st session.

The map alluded to shows the proposed plan of improvement, and the estimates of cost are set forth in full detail at pp. 93 to 95 of the above mentioned Senate document.

They amount to the following sums, viz:

1. For close piling	$18,360 56
2. For two piers at the mouth of Grand river	134,047 20
3. For dredging	7,777 84
Total, to complete Grand river harbor, Michigan	160,185 60

In view of the pressing demand for this improvement, arising from the commercial connexion lately completed, through it, between the great eastern and western markets, added to the value of this harbor, when improved, as a harbor of refuge for the mid-coast on the east side of Lake Michigan, I would now recommend that the above sum be granted in two annual appropriations of $80,092 80 each.

13. SOUTH BLACK RIVER, MICHIGAN.

This place came under my official attention through the instructions of August 15, 1856, based on the resolutions of the United States Senate of the 4th of that month.*

The first step for me to take, in pursuance of this authority, was to cause to be made an accurate survey of the locality. This was done in the same month in which the resolutions of the Senate were passed, and the result of the survey was projected on a map marked G No. 50, now in the Topographical Bureau and in the archives of the United States Senate.

In my annual report for 1857, printed in Senate (Ex.) Doc. No. 42, of the 35th Congress, 1st session, the improvement of this harbor is treated of, see pp. 98 and 99.

An estimate was also presented for the necessary work, amounting to the sum of $39,180 61.

I beg leave to renew that estimate here.

14. KALAMAZOO RIVER, MICHIGAN.

Under the same authority as in the case of the next preceding harbor, I caused a survey to be made of the mouth of Kalamazoo river in September, 1856. The map projected from that survey, marked G No. 51, was forwarded to the Topographical Bureau with my annual report for 1857. A copy of it is in the archives of the United States Senate.

It shows the nature of the improvement which is desired by the people of the neighboring counties. The report and estimates in this case will be found printed in Senate (Ex.) Doc. No. 42, of the 35th Congress, 1st session, at pp. 99 and 100.

I beg leave to renew the estimate there given in detail, amounting to $64,099 63.

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* See pages 97 and 98 of Senate (Ex.) Doc. No. 42, of the 35th Congress, 1st session.

II. LAKE ST. CLAIR HARBOR WORKS.

15. MOUTH OF CLINTON RIVER.

No work has been carried on here for want of appropriations since 1855. My reports printed at pp. 468 to 471, and at pp. 473 to 479 of Senate Ex. Doc. No. 16 of the 34th Congress, 3d session, and at pp. 100 and 101 of Senate Ex. Doc. No. 42 of the 35th Congress, 1st session, give full details of all that concerns this improvement.

The estimate for completing this improvement is there given, amounting to	$31,920 00
From which deduct balance now on hand	200 38
Amount required for the completion of the improvement at the mouth of Clinton river, Michigan	31,719 62

For the want of means to complete what was begun here, the work has suffered as all unfinished work must when left exposed to the action of the waves and of the ice in winter. To secure it from further injury and to complete it, I would recommend that the said sum of $31,719 62 be granted in one appropriation.

III. LAKE ERIE HARBOR WORKS.

16. MONROE HARBOR, MICHIGAN.

This harbor suffered much from the storms of last winter and spring, and will no doubt suffer much more between the present time and next spring.

I recommend, in its behalf, a speedy appropriation of the amount of my estimate of last year, given in full detail at page 102 of Senate Ex. Doc., No. 42, of the 35th Congress, 1st. session.

It amounts to the sum of $23,857 90. No balance remains of the appropriation of 1852 for this work.

17. SANDUSKY HARBOR, OHIO.

The works for the protection of this harbor have suffered much since the period of my last annual report. This has been owing chiefly to their incomplete condition, and the unusually high stage of Lake Erie throughout the season of 1858. From this high stage of the water the works have in part, been submerged, and thereby much injured. I am obliged, therefore, to increase the estimates in order to prevent further injury, and to complete the harbor protection.

The importance of this harbor to the people of Ohio, and to the lake navigation demands that it should be immediately attended to.

I submit the following estimate for the accomplishment of this object, viz:

1. For the repair of 3,350 feet of pier work for the protection of the peninsula, at $2 50 per lineal foot····	$8,375 00
2. For the construction of 4,060 feet of new pier work in continuation of said protection, at $5 per lineal foot······································	20,300 00
3. For a line of pier work between the western extremity of Peninsula Point and the main land. This will require 90 cribs, each 32 feet long, by 20 feet wide, and 15 feet high, at $1,200 per crib, to be constructed after the specifications contained in table T 1, at pp. 12 to 15 of Senate Ex. Doc., No. 16, of the 34th Congress, 3d session, and the drawings in map G 19, in the Topographical Bureau·····················	108,000 00
4. For 450 feet lineal of pier work to connect the above (item 3) pier with the line of pier work now built, at $5 per lineal foot·······················	2,250 00
Sum······································	$138,925 00
Add 5 per cent. for contingencies···················	6,946 25
Amount required for Sandusky harbor, Ohio·········	$145,871 25

In view of the great importance of this harbor, and the call for prompt attention to it, required by its present precarious condition, I recommend that the above sum be granted in two equal annual appropriations, each to be $72,935 62.

No balance remains of the former appropriation for this harbor.

18. HURON HARBOR, OHIO.

No balance remained for this harbor when it was turned over to me in December, 1856.

The works have suffered very much since the period of my annual report for 1857, and they are now in a very precarious condition, and nothing can be done for them until another appropriation shall be made.

To save these works from total destruction and to protect the harbor, I recommend the following repairs and improvements, with estimates of cost, viz :

1. *East pier.*

1. For the repair of 335 feet of this pier, by rebuilding on the old foundation to a height of five (5) feet above the water surface·····························	$7,500 00
2. For the repair of 520 feet inside the harbor·······	4,500 00

3. For an additional crib at the lakeward extremity of this pier, thirty-two feet long and twenty feet high from the bottom to the top, to be in sixteen feet water	$3,525	00
Sum	15,525	00
Add ten per cent. for contingencies	1,552	50
Amount required for the east pier	17,077	50

2. *For the west pier.*

To rebuild 1200 lineal feet of pier, twelve feet wide, to a height of five (5) feet above the present water surface	25,500	00
Add ten per cent. for contingencies	2,550	00
Amount required for the ~~ea~~west pier	28,050	00

Recapitulation.

1. For the east pier	17,077	50
2. For the west pier	28,050	00
Amount required for Huron harbor, Ohio	45,127	50

I recommend that this sum be granted in one appropriation.

19. VERMILLION HARBOR, OHIO.

The piers of this harbor are entirely decayed above the water level, and hence this portion of each must be renewed, to a height of six feet throughout.

Besides this general decay above the water level, the lakeward end of the east pier is dilapidated for a distance of 115 feet, to a depth of three and a half feet below the water level.

The following repairs are therefore required, for which I submit estimates, viz :

1. *The east pier.*

1. To raise 115 feet in length of this pier from three and a half feet below to five feet above the water level	$2,500	00
2. To rebuild 325 feet from the water surface to six feet above it	8,750	00
3. To repair 750 feet inland	9,987	50
Sum	21,237	50
Add ten per cent. for contingencies	2,123	75
Amount required for the east pier	23,361	25

2. *For the west pier.*

1. To build 135 feet to a height of 6 feet	$3,500 00
2. To rebuild from the water-level to 6 feet above the same, 1,000 feet	15,000 00
3. For repair of 450 feet of pier on its river face	1,875 50
Sum	20,375 50
Add 10 per cent. for contingencies	2,037 50
Amount required for the west pier	22,413 00

Recapitulation.

1. For the East pier	23,361 25
2. For the West pier	22,413 00
Amount required for Vermillion harbor, Ohio	45,774 25

I recommend that this sum be granted in one appropriation.

20. BLACK RIVER HARBOR, OHIO.

No funds remain of the last appropriation for this harbor, nor has any appropriation been made for it since the year 1852.

At that period only five thousand dollars ($5,000) were appropriated for it. This sum was very inadequate to the repairs then required, and the work of dilapidation has been going on from that time to this, so that the condition of this harbor is now such that if means be not very soon granted for its relief, it must be altogether lost to the object for which it was constructed.

The repairs now required, and the estimated cost of making them, are as follows, viz:

1. *For the east pier.*

1. To rebuild 354 feet of pier from 3 feet below the present water-surface to 5 feet above the same	$9,125 00
2. To rebuild and repair 700 feet from 1 foot below the water-surface to 5 feet above the same	6,785 50
3. To repair the inner face for 230 feet	1,115 76
4. For one additional crib at the extremity of this pier	3,500 00
Sum	20,526 26
Add 10 per cent. for contingencies	2,052 62
Amount required for the east pier	22,578 88

2. *For the west pier.*

1. For the repair of 150 feet of the north portion of this pier	$2,333 33
2. For rebuilding 250 feet on the inner end of pier	4,116 67
3. To repair 800 feet of pier inside of the harbor	5,250 00
Sum	11,700 00
Add 10 per cent. for contingencies	1,170 00
Amount required for the west pier	12,870 00

Recapitulation.

1. For the east pier	22,578 88
2. For the west pier	12,870 00
Amount required for Black river harbor, Ohio..	35,448 88

I recommend that this sum be granted in one appropriation, because the dilapidated state of the work renders delay in effectually repairing it very hazardous.

21. CLEVELAND HARBOR, OHIO.

No appropriation has been granted for this harbor since that of 1842. The importance of this harbor to the general commerce of the lakes, and to a great portion of the State of Ohio, is too well understood to need any explanation here on the subject.

The outer end of the east pier, which is built of stone, is very much in need of repairs from the displacement of the stones arising from the action of the waves in rough weather. It is very important that this should be attended to with as little delay as possible. When dilapidation of a stone structure, like this, once begins, it is far more rapid and mischievous than in a wooden structure, unless immediately checked. It would be a great misfortune if this fine harbor should be allowed to deteriorate for want of these repairs, and they cannot be made until an appropriation is granted for the purpose.

The west pier should be completed.

For these objects I present the following estimate:

1. *The east pier.*

1. For repairing the outer end of this pier, by removing the stone from the injured portion, and rebuilding with the same	$8,433 66

2. For tearing away the wood work north of the position of the beacon, and building up with stone similar to the rest of this pier	$21,243 20
Sum	29,676 86
Add 10 per cent., for contingencies	2,967 68
Amount required for the east pier	32,644 54

2. *For the west pier.*

For completing the west pier according to the plan heretofore approved, and its connexion	23,120 00
Add 10 per cent., for contingencies	2,312 00
Amount required for the west pier	25,432 00

Recapitulation.

1. For the east pier	32,644 54
2- For the west pier.	25,432 00
Amount required for Cleveland harbor, Ohio	58,076 54

I recommend that this sum be granted in one appropriation with a view to the completion of this very important work without further delay.

22. GRAND RIVER HARBOR, FAIRPORT, OHIO.

The last appropriation for this harbor was ten thousand dollars ($10,000,) made in the year 1852.

It was all expended by my predecessor more than three years ago in making the repairs that were most needed, and it was insufficient for all that were then required.

I repeat here the recommendations contained in my last annual report in regard to this harbor, which are:

1. That the east pier be extended, on its present direction, a distance of 416 feet, and that the west pier be extended 320 feet parallel with the east pier.
2. That a portion of the old pier work, which is rotten, be torn away and rebuilt with sound timber.
3. Dredging.

For these several objects detailed estimates were submitted with my annual report for 1857; to be fouud, marked K, at pages 108 and 109 of Senate Ex. Doc. No. 42 of the 35th Congress, 1st session, amounting to the sum of $41,498 94 as follows, viz:

1. For the pier extensions	$32,819 39
2. For tearing away old pier work and repairing	6,179 55
3. For dredging and repairs of steam dredge	2,500 00
Amount required for Grand River harbor, Fairport, Ohio	41,498 94

I renew this estimate and recommend that the amount be granted in one appropriation.

23. ASHTABULA HARBOR, OHIO.

The last appropriation made for this harbor was ten thousand dollars, ($10,000,) granted in the year 1852. It was expended by the end of the year 1855 in making repairs, and extending the harbor piers.

The old piers now require repairs to prevent breaches in them by the lake sea in high winds.

To complete this harbor, the windward pier should be extended out 416 feet, and the leeward pier 288 feet. This will require for the first, thirteen cribs, and for the second, nine cribs; or for both piers twenty-two cribs; each to be thirty-two feet long, twenty feet wide; and they will cost, each, $1,426 98, including all contingencies.

1. Hence, twenty-two cribs, at $1,426 98 each, gives for the pier extensions	$31,393 56
2. For repairs of the old piers	5,750 00
3. For dredging 12,500 cubic yards, at 14 cents per cubic yard	1,750 00
Total required for Ashtabula harbor, Ohio	38,893 56

I would recommend that this sum be granted in two annual appropriations, as follows, viz:

The first year	$25,000 00
The second year	13,893 56
Amount as before	38,893 56

24. CONNEAUT HARBOR, OHIO.

The last appropriation made for this harbor was ten thousand dollars, (10,000,) in the year 1852. No balance of that appropriation now remains. The whole was expended upon the work before I was placed in charge.

A new appropriation is now required to complete the piers here by extending them out to twelve feet depth of water at the mean stage of Lake Erie.

This will require an extension of the west pier of 352 and an extension of the east pier of 288 feet. The first will require an addition of eleven (11) cribs, and the second an addition of nine (9) cribs; total twenty cribs, each thirty-two feet long, twenty feet wide, and twelve (12) feet average height from the bottom to the water surface. They will cost, each, $1,426 98.

1. Hence, twenty cribs, at $1,426 98 each, will cost	$28,539 60
To which add:	
2. For repairs of present piers	1,250 00
3. For dredging 18,000 cubic yards, at 14 cents per cubic yard	2,520 00
Amount required for Conneaut harbor, Ohio	32,309 60

I would recommend that this sum be divided into two annual appropriations, as follows, viz:

The first year	$20,000 00
The second year	12,309 60
Total, as above	32,309 60

25. ERIE HARBOR, PENNSYLVANIA.

This is the only harbor on the lakes which belongs to the State of Pennsylvania.

It is of great importance to her inland trade, and will be of still greater importance when the Sunbury and Erie railroad, now in progress of construction, shall be completed.

The grading is all completed for this road, and the rail track is mostly laid. It will be completed and in operation some time during the present winter, probably as early as January, 1859. It will open a direct communication between Philadelphia and Erie. It will constitute an important link, both for commerce and travel, lying entirely within the State of Pennsylvania and connecting her great Atlantic port with her only lake port. The route passes through a region of country abounding in agricultural and mineral wealth.

The State of Pennsylvania, through the influence of this great work of internal improvement, is deeply interested in the preservation of the harbor of Erie in good condition for the easy accommodation of the largest class of lake vessels.

The general commerce of the lakes must often look to this harbor, also, as a port of refuge from the frequent and sudden gales which prove every year so destructive to shipping and to human life. All these considerations, added to the value of this harbor as a naval station and port in time of war, seem to constitute a strong claim on the government to complete its improvement, and I would respectfully recommend immediate attention to it.

In my annual report for 1857, the repairs which were then required in order to stop breaches in the piers of this harbor, were fully stated. An immediate appropriation for this especial object was urgently recommended, but it was not granted. The additional dilapidation which has since taken place on portions of the piers which were built at an early period, makes a larger sum now necessary to put them in proper order.

The northwest channel pier is much injured in several places. The extreme crib, situated at the lake-ward extremity of this pier, is greatly damaged by the collision of vessels while entering the harbor in strong gales of wind.

The deepest water is near this point, and the channel being narrow here for the larger class of vessels, they are compelled, for fear of getting aground, to run close to this pier-head. Of course collisions will often take place in dark weather until the channel shall be widened here by dredging, a measure that ought, in our opinion, to be immediately resorted to. The beacon light formerly stood at the extremity of this pier, but its security having been rendered precarious by these collisions near its base, and by its having been once dragged down, as I was informed, by the yards of a vessel while passing close to the pier in entering the harbor, this beacon has, under the direction of the officer acting under the Light-house Board, been recently removed further inward and placed on a separate foundation beyond the reach of similar accidents.

There are four other bad breaches in this pier, which are growing worse every day. The first is 250 feet, and the second is 350 feet from the lakeward end of the pier. Each is about thirty (30) feet long, and if not soon repaired, they will grow into one wide breach of one hundred and sixty (160) feet in length, measured along the pier. There are two others further in towards the harbor, of twenty-five (25) feet length each.

This portion of the pier was constructed according to the old and now exploded fashion of using wooden pins (treenails) for fastening the timbers together, instead of bolts of wrought iron. The weight of the stone ballast within the cribs has, in many places, broken these treenails below the water level, and as a necessary consequence the same weight has pressed the timbers which form the main wall, or water-face of the pier, entirely out of place. Repairs are in such cases difficult and expensive. They can only be made by first tearing away the original work and rebuilding in place of it, or by protecting the whole water-face of the pier by means of close piling of oak timber, hewn or sawed one foot square, clear of sap.

The harbor, or bay-end of this pier, is entirely torn away above the water-level for a length of fifty (50) feet. It has been done by the collision of vessels, which, in order to keep in a sufficient depth of water, are obliged to pass within twenty (20) feet of this point. The channel should be widened here by dredging. The immersed part of the pier should be built up again to its proper height above the water. In its present condition, being concealed from view, it is dangerous to every vessel that passes down.

The north breakwater pier was injured by autumn and winter gales, so frequent since the date of my last annual report. Its repair was then estimated to cost $1,873 00. It is now estimated at $2,375 00, as will appear by the item in the accompanying estimate, marked D 1.

This structure, like the one previously mentioned, is much weaker from the fact that wooden trenails were used for binding the timbers together. Iron bolts cannot, I conceive, be dispensed with for such a purpose, and there is economy in the end produced by the free use of the best American wrought iron for all such purposes.

The brushwood (facines) placed by the late Colonel William Turnbull to stop the breach near Peninsula Point, has proved of good effect. The depth in this breach is now greater than usual, owing to the present unusual height of the surface of Lake Erie.

I recommend that this mode of closing this breach, and the like one of protecting the lakeward shore of the island from further abrasion, be persevered in.

Dredging is immediately required along the channel between the piers, and near the entrance from the lake.

I would recommend that the northwest channel-pier be extended out 224 feet by the addition of 7 (seven) cribs, each thirty-two feet long, twenty feet wide, and of an average height of twenty feet from bottom to top.

The Sunbury and Erie Railroad Company has constructed a line of pier work, consisting of a succession of detached cribs parallel to the old United States eastern, or southeastern channel pier, and nearer to the southeastern shore of the bay. The channel bounded by this company's pier on the one side, and the United States northwestern channel pier on the other, is thus much widened and better adapted to the present state of the lake commerce carried on at this port. It is not now, therefore, recommended to repair this old United States southeastern channel pier.

It is probable that it may become necessary at a future time, not far distant, to remove the greater portion of it.

For the objects above specified I beg leave to refer to the accompanying estimates marked D 1, amounting as follows, viz:

1. For the repair of the northwestern channel pier……	$4,500
2. For the repair of the north breakwater pier…………	2,350
3. For dredging the channel within the bay, and also the ship entrance lakeward of the channel piers……………	15,000
4. For stopping the breach near Peninsula Point…………	2,200
5. For protecting the lakeward shore of the island from abrasion……………………………………	3,500
6. For extending the northwest channel pier……………	14,840
Amount required for Erie harbor, Pennsylvania………	42,590

In view of the great value of this harbor to the lake-coast commerce, as well as to a very large portion of the people of Pennsylvania, I recommend that this sum be granted in one appropriation.

The appropriation for this harbor made in 1852 having been expended, it became my duty under the regulations of the War Department, to dispose if possible by sale of the public property which remained unapplied to the works, and from the proceeds to close all outstanding accounts against said harbor.

Accordingly in April, 1857, I directed the custodian of the property there to advertise it for sale, and to invite bids for it. This was done by advertisements in the "Erie Weekly Observer," from the 11th to the 25th of April, 1857. A copy of that advertisement is hereto attached, marked D 2. No bids were, however, received; nor could the custodian succeed in disposing of the property on any terms short of a complete sacrifice, about equivalent to giving it away.

Again I caused this property to be advertised both in the "Erie Weekly Observer" and also in the "Buffalo (N. Y.) Daily Courier, from January 30 to March 4 and 6, and thence again to April 1, 1858, and every effort within my power was made to dispose of it on any thing like reasonable terms, but without success. No bids were offered.

The quarterly returns will show that this timber cost the United States more than three thousand dollars, ($3,000,) and I could not abandon it in order to discharge the custodian. Yet there was no money to pay him his monthly wages.

The timber is still valuable for the purposes of the United States in making the repairs that must go on at Erie so soon as another appropriation shall be made. It gives the custodian, however, a claim for his services beyond the time that there was any money to pay him, a case which is anomalous under the rule laid down for the sale of public property when an appropriation shall be exhausted.

I submit it for the decision of the proper authority.

After I reported the condition of the United States steam dredge-boat for Lake Erie, by my letter No. 183, of September 3, 1857,* and also after I received the authority to repair her, contained in your reply of November 11, 1857,* I found that she lay sunk in the dock at Erie from a hole in her bottom made by getting on her anchor.

I made arrangements with a party at Buffalo, New York, to raise and repair her; but on a personal inspection of her in the early part of August last, I came to the conclusion that she was safer as she lay, inasmuch as her machinery had been taken out and stored ashore, and there were scarcely funds enough to raise her and put her on a dry dock and repair her. She lies in a safe position and will be less liable to injury than if raised and left unemployed.

When a new appropriation shall pass for her employment she will be properly attended to.

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* See documents marked L 6, and L 7, at pages 117 and 118 of Senate Ex. Doc. No. 42 of the 35th, Congress, 1st session.

D 1.

Estimate of the cost of repairs immediately required at Erie harbor, Pennsylvania, of extending the northwestern channel pier 224 *feet lakeward, and of dredging.*

1. Repair of the northwestern channel pier:	
For repairing the lakeward end of this pier by tearing away the timber work to the lowest water surface, and then building up and filling with stone to the flooring at top	$1,500 00
For repairing four breaches in this pier, described in the report	1,425 00
For rebuilding 50 feet in length of the bay end of this pier, to a height of 5 feet above the high water level	1,575 00
Total for the northwest channel pier	$4,500 00
2. For the repair of the north breakwater pier:	
For materials and workmanship	$2,350 00
3. For dredging:	
For excavating and removing 25,000 cubic yards from the channel of the inner bay, at 20 cents per cubic yard	$5,000 00
For excavating and removing 20,000 cubic yards from the outer bar, at 50 cents per cubic yard, being rocky in many places	10,000 00
Total for dredging	15,000 00
4. For stopping the breach near Peninsula point with brush wood	$2,200 00
5. For protecting the lakeward shore of the island from abrasion by brush wood	$3,500 00
6. For extending the northwest channel pier 224 feet lakeward:	
This will require seven cribs, each 32 feet long, 20 feet wide, and of an average height of 20 feet from bottom to top. This will require seven cribs to be constructed as per the drawings in the sheet marked G 20, in the Topographical Bureau, and the specifications in the table marked T 2, printed at pp. 16 to 18 of Senate Ex. Doc. No. 16, of the 34th Congress, 3d session. The cost of each crib is estimated at $2,120. Therefore for the 7 cribs	$14,840 00

Recapitulation.

1. For the repair of the northwestern channel pier····	$4,500 00
2. For the repair of the north breakwater pier·······	2,350 00
3. For dredging the channel within the bay, and also the ship entrance lakeward of the channel piers····	15,000 00
4. For stopping the breach near Peninsula point with brush wood (facines)························	2,200 00
5. For protecting the lakeward shore of the island from abrasion ·······························	3,500 00
6. For extending the northwest channel pier·········	14,840 00
Amount required for Erie harbor, Pennsylvania·	42,590 00

J. D. GRAHAM,
Major Corps of Top'l. Eng'rs, Bvt. Lieut. Col. Sup'tg Eng'r.
OFFICE GENERAL SUPERINTENDENCE OF LAKE HARBOR WORKS,
Chicago, November 15, 1858.

D 2.

[From the Erie (Pa.) Weekly Observer, from April 11 to April 25, 1857.]

Government timber for sale.

Sealed proposals will be received by the undersigned until the 1st day of May, for the following lot of white oak, cucumber, ash, and hemlock timber, lying on the bank of the lake at the foot of Holland street, at A. J. Kelso's warehouse, and at north end of the bay, near the old carpenter shop.

198 white oak piles 12 by 12 inches, 24 feet long.

4,520 feet, board measure, white oak timber, 12 by 12 inches, 30 feet long and 6 by 10, 14 feet long for dock timber and ties, square hewed, full corners.

176,294 feet, hemlock, same size as No. 146,620 feet, board measure. Cucumber and ash, same size and length as white oak.

The bids should be made by the thousand feet, board measure.

Terms of sale cash, 20 per cent. in hand on day of sale, balance as soon as measured and delivered.

J. J. LINTS,
United States Agent and Custodian.

ERIE, *April* 11, 1857.

D 3.

[From the Erie (Pa.) Weekly Observer, from January 30 to March 6, 1858.]

Government timber for sale.

Sealed proposals will be received until the 1st day of April, 1858, for the following lot of timber, at Erie, Pennsylvania, viz: White oak, cucumber, ash, and hemlock timber, lying on the bank of the lake at the foot of Holland street, at A. J. Kelso's warehouse, and at the north end of the bay, near the old carpenter shop. Dimensions as follows, viz:

		Length.	Size.
3,744	cubic feet of white oak	24 feet	12 x 12
133	cubic feet of white oak	20 feet	6 x 10
5,050	cubic feet of cucumber and ash	30 feet	12 x 12
160	cubic feet of cucumber and ash	16 feet	12 x 12
3,075	cubic feet of cucumber and ash	20 feet	8 x 8
64	cubic feet of cucumber and ash	16 feet	8 x 8
10,200	cubic feet of hemlock	30 feet	12 x 12
112	cubic feet of hemlock	16 feet	12 x 12
1,777	cubic feet of hemlock	20 feet	8 x 8

The bids should be made for the cubic foot, for each kind of timber separately. Parties can bid for the whole or in parcels to suit.

All proposals must be addressed to Lieutenant Colonel J. D. Graham, superintending engineer of lake harbors, Chicago, Illinois, and will be subject to the decision of that office. Terms of sale: Specie of United States coin, to be paid as soon as measured and delivered.

Erie, *January* 30, 1858.

D 4.

[From the Buffalo (N. Y.) Daily Courier, from January 30 to March 4, 1858, and thence to April 1, 1858.]

Government timber for sale.

Sealed proposals will be received until the first day of April, 1858, for the following lot of timber, at Erie, Pennsylvania, viz: White oak, cucumber, ash, and hemlock timber, lying on the bank of the lake, at the foot of Holland street, at A. J. Kelso's warehouse, and at the north end of the bay, near the old carpenter shop. Dimensions as follows, viz:

		Length.	Size.
3,744	cubic feet of white oak	24 feet	12 x 12
133	cubic feet of white oak	20 feet	6 x 10
5,040	cubic feet of cucumber and ash	30 feet	12 x 12
160	cubic feet of cucumber and ash	16 feet	12 x 12
3,075	cubic feet of cucumber and ash	20 feet	8 x 8

		Length.	Size.
64	cubic feet of cucumber and ash·········	16 feet	8 x 8
10,200	cubic feet of hemlock··················	30 feet	12 x 12
112	cubic feet of hemlock··················	16 feet	12 x 12
1,777	cubic feet of hemlock··················	20 feet	8 x 8

The bids should be made for the cubic foot, for each kind of timber separately. Parties can bid for the whole or in parcels to suit. All proposals must be addressed to Lieutenant Colonel J. D. Graham, superintending engineer of lake harbors. Chicago, Illinois, and will be subject to the decision of that office. Terms of sale: specie of United States coin, to be paid as soon as measured and delivered.

ERIE, *January* 30, 1858.

26. DUNKIRK HARBOR, NEW YORK.

In regard to this harbor I will refer to my annual report of last year. It is printed at pp. 119 to 122 of Senate Ex. Doc. No. 42 of the 35th Congress, 1st sesion.

The estimate then submitted for repairs was $5,299 96. Nothing was however appropriated and the works have suffered so much that I am obliged now to ask for $7,320 for that purpose.

In addition to this item I recommend that $80,363 73 be appropriated for continuing this work, which, added to the above item for repairs, makes the sum of $87,683 73 as required for this work by the first appropriation.

27. BUFFALO HARBOR, NEW YORK.

No work has been done at this harbor, for want of means, since 1856. It is in a worse condition than that which was stated in my annual report for 1857. The sum of $27,679 35 was then estimated as necessary for repairs. I estimate that $30,000 (thirty thousand dollars) are now necessary for the repairs of the parts specified in that report, and I would recommend that it be granted in one appropriation. Please see my report for 1857 on this harbor, printed at pp. 122 and 123, inclusive, of Senate Ex. Doc. No. 42 of the 35th Congress, 1st session.

AN ADDITIONAL STEAM DREDGE BOAT FOR LAKE ERIE.

I beg leave here to renew my recommendation for an additional steam dredge boat and six mud scows for Lake Erie, and to refer you to my views on this subject as expressed in my annual report for 1857, printed at pp. 123 to 126 of Senate Ex. Doc. No. 42 of the 35th Congress, 1st session, and also to the estimates therein given in full detail of items, amounting to the sum of $19,232, which I would recommend to be granted in one appropriation, at as early a day as may be considered expedient.

Also the sum of $1,950 for raising and repairing the United States steam dredge boat now lying at Erie, as per estimate printed at page 126 of said document.

IV. LAKE ONTARIO HARBOR WORKS.

28. OAK ORCHARD HARBOR, NEW YORK.

The balance of the last appropriation for this harbor was expended in dredging in the summer and autumn of 1857.

The benefit of that work continues to be felt and appreciated, and it is very desirable that it should be pushed still further.

I beg leave here to renew my estimate of last year for the completion of this harbor on the plan therein referred to. The whole subject will be found in my annual report for that year, as printed in Senate Ex. Document No. 42 of the 35th Congress, 1st session, at pp. 127 to 137, inclusive.

The estimates are given in full detail at pp. 136 and 137.

The items are as follows, viz:

1. For the pier extensions	$46,927 80
2. For dredging	4,834 10
Total for completing Oak Orchard harbor, New York	51,761 90

I would recommend that this sum be granted in three equal annual appropriations, each of	$17,253 97
To which add the amount required immediately for repairs, as per estimate marked O 13, at page 136 of the above mentioned document	9,736 65
Amount required for the first year's appropriation for Oak Orchard harbor, New York	26,990 62

29. GENESEE RIVER HARBOR, NEW YORK.

This harbor is at the mouth of Genesee river. It was formerly called Charlotte harbor.

The last appropriation by Congress was twenty thousand dollars ($20,000) for this harbor, in the year 1852. It was nearly all expended the following year, under the direction of Colonel Turnbull, in repairing the west pier, which is 1,943 feet long, and was in a very bad condition before he had it attended to.

The east pier was reported by Colonel Turnbull, as long ago as September, 1853, to be in a very bad condition, and an appropriation of $21,530 was recommended by him for its repair; but it was not granted, and the dilapidation went on to such a degree that it must now be entirely rebuilt from two feet below to five feet above the water level. There are also portions that are dilapidated to a great depth below the water surface, and as that distinguished and much lamented officer justly stated in his annual reports for 1855 and 1856, "in moderate gales of wind it is entirely submerged, which renders the approach of vessels to the entrance very dangerous."

For the repairs now required I present the estimate herewith marked E, amounting to $41,084 34.

In order to the timely saving of the harbor, it would be judicious to grant this sum in one appropriation.

E.

Estimate of the cost of repairing the East pier of Genesee River harbor, by tearing away the old work to two feet below the water level, and then building up to five feet above that level. Total height of new work, 7 feet.

For 76,288 lineal feet of oak timber hewn or sawed 1 foot square, at 18 cents per foot	$13,731 84
For 95,488 feet, board measure, of white oak plank 3 inches thick and 8 inches wide, in pieces 20 feet long, for flooring, at $18 per M	1,718 78
For 67,392 pounds of wrought iron, 1 inch square, for bolts, at 4 cents per pound	2,695 68
For 8,768 pounds of wrought iron spikes ⅜ inch by ⅜ inch square, at 7½ cents per pound	657 60
For 1,376 cords of ballast stone, at $3 50 per cord	4,816 00
Cost of materials	23,619 90
For superintendence, carpentry and labor, at $120 per 32 lineal feet	7,627 50
Cost of new work	31,247 40
For tearing away and removing the materials of the old decayed work, 2,034 lineal feet, at $3 per lineal foot	6,102 00
Sum	37,349 40
Add 10 per cent for contingencies	3,734 94
Amount required for Genesee River harbor, New York	41,084 34

J. D. GRAHAM,
Major U. S. Corps Top. Eng., Bvt. Lt. Colonel, Supt'g Engr.

OFFICE GENERAL SUPERINTENDENCE OF LAKE HARBOR WORKS,
Chicago, November 15, 1858.

30. SODUS BAY HARBOR, WAYNE COUNTY, NEW YORK.

There has been no appropriation for this harbor since 1852, when there was one of ten thousand dollars, ($10,000.)

This was entirely inadequate to the repairs of the piers then needed. It was nearly all expended in 1853, under the late Colonel

Turnbull, in repairing the east channel pier, and a part of the east harbor pier.

The remainder of the east harbor pier, and also the entire west pier from the point formerly occupied by the beacon light to the beach, is entirely rotten, and both must be rebuilt from two feet below the water level to five feet above that level.

It was predicted in my last annual report that unless repairs were soon made, this beacon-light would be overthrown by the first severe storm.

The prediction was verified in November, 1857, much to the inconvenience of navigation here.

For full information respecting this harbor, the dredging which was done there under my direction last season, the improvements that are projected to connect with it, and the amount necessary to complete it, I beg to refer to my last annual report, which is printed in Senate Ex. Doc. No. 42, of the 35th Congress, 1st session, at pp. 139 to 147.

I beg leave also to renew my estimate, therein presented in full detail, marked Q 1, at page 141, amounting to········ $40,806 00

In order to save this harbor, I recommend that the above sum be granted in one appropriation.

31. SODUS BAY HARBOR, CAYUGA COUNTY, NEW YORK.

The only appropriation for this work was ten thousand dollars. ($10,000,) in 1852.

The work was commenced in the year 1854, and two hundred and forty (240) feet in length of the west pier was built, and a deposit of stone was made to connect it with the west shore of the bay, in order to the formation of a beach which proved advantageous.

A channel eight feet deep was excavated from the bay to the lake. Want of means has prevented the continuation of the work by the United States.

For full information in regard to the great natural advantages of this harbor, and the improvements which have already been connected with it, and those which are going on, I beg to refer to the part of my annual report for 1857, printed at pp. 147 to 153 in Senate Ex. Document No. 42, of the 35th Congress, 1st session.

I also beg to renew my estimates for this work, which will be found printed in full detail of items at pp. 148 and 149 of said document, amounting to $52,602 18.

I recommend that this sum be granted in two annual appropriations, as follows, viz:

The first year······································	$30,000 00
The second year····································	22,602 18
Amount, as above, required for Sodus Bay harbor, Cayuga county, New York·················	52,602 18

The larger sum is required the first year in order to procure the necessary materials and machinery in advance.

32. OSWEGO HARBOR, NEW YORK.

The precarious condition of the works for the protection of this admirable commercial port was fully set forth in my annual report for 1857, and an appropriation was earnestly asked for, in order to enable us to commence with the opening of the spring of 1858 the repairs which were most needed. Unfortunately no aid was granted, and, as was fully anticipated and predicted in such an event, the work of dilapidation has gone on since the date of that report at a fearful rate.

It has been painful to look on and see portions of that structure, consisting of heavy stone masonry, crumble in our very sight, without the means to check the work of desolation.

A timely appropriation would have saved a very large expenditure, which must now be applied to putting the works in an efficient and safe condition. The local authorities have liberally contributed a portion of the means necessary for the most urgent of the repairs that were needed, but they were not adequate for the remedy of the whole evil.

I would refer here to my report on this harbor, as printed at pp. 153 to 171 in Senate Ex. Document No. 42, of the 35th Congress, 1st session.

At pp. 155 and 156 will be found an estimate in detail for what was then needed, amounting to $46,391 44.

The best I can now do is to renew that estimate with an increase o fifteen per cent., that is to say, $6,958 71 for the increased damage which the work has sustained since the date of that report, which will bring the sum now required for this harbor to the sum of $53,350 15.

This sum judiciously applied would put the harbor works in a secure condition, and I would respectfully recommend the granting of it in one appropriation.

33. OGDENSBURG HARBOR, NEW YORK.

In regard to this harbor I beg to refer to my last annual report as embodying all the information I have to offer in reference to it. I would renew the recommendation therein contained that an appropriation of twenty thousand dollars ($20,000) be granted for this harbor, to be applied according to such plan as may be presented to the War Department and approved by it.—(See page 171 of the above mentioned Senate document.)

AN ADDITIONAL STEAM DREDGE BOAT FOR LAKE ONTARIO.

I beg to renew here my recommendation of last year that an additional steam dredge, with six mud scows, be immediately constructed for the harbors on Lake Ontario. The importance of dredging was fully discussed in that report and need not be repeated here.

I renew the estimate given at page 172 of the above mentioned Senate document, amounting for this object to $19,232.

V. LAKE CHAMPLAIN HARBOR WORKS.

34. BURLINGTON BREAKWATER, VERMONT.

No appropriation having been granted for this work since it was committed to my charge, nothing has been done within that period.

The work, although highly useful in its present condition, requires to be extended on the plan described in my annual report in order to afford a more complete shelter from northwest winds to vessels seeking a safe anchorage behind it.

For this purpose, and certain repairs that are much needed, I beg to renew the estimate which I presented in full detail with my last annual report, to be found at pages 172 to 174 of the above mentioned Senate document.

The items are as follows, viz:

1. For completing unfinished work and for repairs	$2,186 40
2. For extending the breakwater 200 feet to the northward	19,099 91
Amount required to complete the Burlington breakwater, Vermont	21,286 31

35. THE FOUR STEAM DREDGE BOATS ON THE LAKES.

There are now four steam dredge boats on the lakes within the district assigned to my charge, namely: One on Lake Michigan, one on Lake Erie, one on Lake Ontario, one on Lake Champlain.

There is no more vital interest to the lake harbors than that these valuable machines should constantly be kept, together with their attendant mud-scows, in good working condition.

A special appropriation is however absolutely necessary for this purpose.

I would earnestly recommend that, for this especial object, there be appropriated for each of these machines and its appurtenances, including the scows, the sum of $2,500; or—

For the four machines and their appurtenances	$10,000

36. THE NEW LIGHT-HOUSE FOR CHICAGO HARBOR.

This work has demanded much of my attention the present year. The position adopted for it is the most advantageous to mariners, because it is situated at the critical point in entering the harbor of Chicago,* and besides it serves the double purpose of a coast light and a harbor beacon.

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* See map G, No. 52. Also, Senate Executive document No. 16, of the 34th Congress, 3d session, pages 102, 103, &c.

At the same time that it secures these eminent advantages the work, while going on, was almost constantly exposed to the violent action of the lake sea, owing to a prevalence of easterly winds, and my personal attention during a great part of the working season had to be given to this work to prevent disasters, loss of machinery, materials, &c.

While my report on the progress of this light-house is due and will be made to the Light-house Board, it seems proper that I should here say this much on the subject.

The peirs of defence are completed on the lakeward sides, and but for unusually rough weather in October and November, the new light would have been shown to mariners the present season.

All of which is respectfully submitted,

J. D. GRAHAM,
Major U. S. Corps of Top'l Eng'rs, Bvt. Lieut. Colonel,
Superintending Eng'r of Lake Harbor Works.

Colonel J. J. ABERT,
Chief Top'l Engineer, Washington.

P. S.—I submit the following recapitulation of items in the foregoing estimates:

RECAPITULATION OF THE ESTIMATES.

Amount of the estimated cost of the completion of the several lake harbor improvements on the northern and northwestern lakes, under the superintendence of Brevet Lieutenant Colonel James D. Graham, major of Topographical Engineers, together with the sums asked the first year towards that object.

Name and nature of work.	Amount required to complete the work.	Sum asked for the first year.
I.—LAKE MICHIGAN HARBOR WORKS.		
1. Chicago harbor, Illinois. Extension and repair of the piers, and dredging, &c.	$219,342 96	$109,671 48
2. Waukegan harbor, Illinois. Construction of 1,380 feet of breakwater	137,966 10	60,000 00
3. Kenosha harbor, Wisconsin. Extension of piers, chevaux-de-frise, sand barrier, dredging basins to give capacity for a harbor of refuge, and removing the bar and deepening the channel between the piers	58,047 24	58,047 24
4. Racine harbor, Wisconsin. Extension of the harbor piers and making a survey of the harbor and dredging	25,422 73	25,422 73
5. Milwaukie harbor, Wisconsin. Repairs of piers at the natural mouth of the river, and dredging	44,631 42	44,631 42
6. Sheboygan harbor, Wisconsin. Extension of piers, repairs and dredging	36,614 55	36,614 55
7. Manitowoc harbor, Wisconsin. Extension of piers and dredging	62,780 94	40,000 00
8. Michigan City breakwater, Indiana. For 2,000 feet of breakwater to form a roadstead for the general commerce of the lakes and for armed vessels	384,376 50	100,000 00
9. New Buffalo harbor, Michigan. For the construction of 1,200 feet of pier work, piling, excavation, and dredging channels and basins, to adapt it as a harbor of refuge to the wants of the local commerce of the place	98,113 47	60,000 00
Additional to render it suitable for a harbor of refuge for the general commerce of the lakes and for armed ships	69,494 32	
10. St. Joseph's harbor, Michigan. Construction of piers, tearing away old work, repairs, and dredging	97,633 91	97,633 91
11. Black Lake harbor, Michigan. Pier construction, close piling, pile-wharfing, excavation, and dredging	128,343 02	42,781 00
12 Grand River harbor, Michigan. Pier construction, close piling, and dredging	160,185 60	80,092 80
13. South Black river, Michigan. Pier construction and dredging	39,180 61	39,180 61
14. Kalamazoo river, Michigan. Pier construction, close piling, and dredging	64,099 63	32,049 81
II.—LAKE ST. CLAIR HARBOR WORKS.		
15. Mouth of Clinton river, Michigan. Close piling and dredging	31,719 62	31,719 62
III.—LAKE ERIE HARBOR WORKS.		
16. Monroe harbor, Michigan. Pier extension, repairs, and dredging	23,857 90	23,857 90

RECAPITULATION—Continued.

Name and nature of work.	Amount required to complete the work.	Sum asked for the first year.
17. Sandusky harbor, Ohio. Pier and breakwater crib-work and repairs	$145,871 25	$72,935 62
18. Huron harbor, Ohio. Pier construction, rebuilding and repairing, and dredging	45,127 50	45,127 50
19. Vermillion harbor, Ohio. Erecting and repairing piers	45,774 25	45,774 25
20. Black River harbor, Ohio. Rebuilding and repairing piers	35,448 88	35,448 88
21. Cleveland harbor, Ohio. Tearing away old work, rebuilding and repairing piers	58,076 54	58,076 54
22. Grand River harbor, Fairport, Ohio. Pier extension and repairs and dredging	41,498 94	41,498 94
23. Ashtabula harbor, Ohio. Pier construction and repairs and dredging	38,893 56	25,000 00
24. Conneaut harbor, Ohio. Pier erection and repairs and dredging	32,309 60	20,000 00
25. Erie harbor, Pennsylvania. Completing the harbor according to the plan of the board of engineers, (not included)		
For immediate dredging and repairing of breaches	42,590 00	42,590 00
26. Dunkirk harbor, New York. To complete the harbor on the plan of the board of engineers, *i. e.:*		
For eastern, middle, and western breakwaters	401,818 66	87,683 73
For immediate repairs of breaches	7,320 00	
27. Buffalo harbor, New York. For repairs of piers, rebuilding wall, and dredging	27,679 35	27,679 35
IV.—LAKE ONTARIO HARBOR WORKS.		
28. Oak Orchard harbor, New York. For extending the harbor piers, repairs of the present piers, and dredging	61,498 55	26,990 62
29. Genesee River harbor, New York. For tearing away old work above low-water level and rebuilding the same	41,084 34	41,084 34
30. Sodus Bay harbor, Wayne county, New York. For tearing away old pier work above low-water level, rebuilding the same, and dredging	40,806 00	40,806 00
31. Sodus Bay harbor, Cayuga county, New York. For pier extension and dredging	52,602 18	30,000 00
32. Oswego harbor, New York. For repairs of wood and stone pier works and dredging	53,350 15	53,350 15
33. Ogdensburg harbor, New York. For improvement of	20,000 00	20,000 00
V.—LAKE CHAMPLAIN HARBOR WORKS.		
34. Burlington harbor, Vermont. Breakwater extension, and completing unfinished work and repairs of old work	21,286 31	21,286 31
a. For surveys of harbors and inlets on the coast of Lake Michigan, to ascertain what other harbors on said lake require improvement, (not included)		
b. For an additional steam dredge boat and eight scows for Lake Erie	19,232 00	19,232 00
c. For repair of the present steam dredge boat and her four scows on Lake Erie	1,950 00	1,950 00

RECAPITULATION—Continued.

Name and nature of work.	Amount required to complete the work.	Sum asked for the first year.
d. For an additional steam dredge boat and eight scows for Lake Ontario	$19,232 00	$19,232 00
e. For repairs of the four steam dredge boats now on Lakes Michigan, Erie, Ontario, and Champlain, $2,500 each	10,000 00	10,000 00
Total	2,945,260 58	1,667,449 30

J. D. GRAHAM,
Major Topographical Engineers, Brevet Lieut. Colonel,
Superintending Engineer.

OFFICE GENERAL SUPERINTENDENCE OF LAKE HARBOR WORKS,
Chicago, November 15, 1858.

Colonel J. J. ABERT,
Chief Topographical Engineer, Washington.

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Annual report of Brevet Lieut.-Col.
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